Chapter 3

Affected Environment And Environmental Effects

Chapter 3 - Affected Environment and Environmental Consequences

Introduction

This chapter is organized by Relevant Issues and Other Issues and Management Concerns and presents a summary of the analysis and the data utilized in completing the analysis. Information on the current condition of the relevant issues and other resources associated with the Project Area is presented in the Existing Condition section. The environmental effects of the relevant issues and other resources associated with the Project Area are described in the Direct and Indirect Effects sections for each alternative. The cumulative effects are evaluated separately for each resource. The environmental analysis for this project used the best available science in planning, analyzing, and disclosing the effects of the proposed activities. The evaluation of effects is tiered to the Forest Plan. The complete analysis, including maps and supporting documentation, is included in the Planning Record.

Relevant Issues

CREATION OF LARGE OPENINGS

Existing Condition

This issue reflects the concern about the creation or maintenance of large openings as a result of some of the aspen clearcuts and opening prescribed burn projects. Comments were received expressing concerns about clearcutting in Compartment 404 and clearcutting in general. Seven aspen stands located in Compartment 404 are proposed for treatment. Approximately 3446 acres of aspen occur on NFS land in the Project Area, of which about 698 acres are in regenerating age classes (20 years or less) (see Table 3-3). Comments were received expressing concern over maintaining openings by burning instead of mowing or brushing. Five upland openings are proposed to be maintained using prescribed burning. Approximately 436 acres of upland openings and lowland brush occur on NFS land in the Project Area (see Table 3-3).

Direct and Indirect Effects

Alternative 1

Under Alternative 1, no creation of large openings, clearcutting, prescribed burning, or other management activities associated with this project would occur in the Project Area on NFS lands. Under this alternative, the amount of openings would decrease as natural succession occurs and stands convert towards later successional vegetation types. The landscape scenery of the area would remain influenced only by natural events, and continue to be a mix of forests and open land and low-density rural residential. Slight visual changes are expected within the next decade as private land owner objectives change. Local environmental events (e.g. wildfire, windstorms) would affect individual trees and small areas of forest land.

Alternative 2

Under Alternative 2, seven aspen units totaling about 108 acres located in Compartment 404 and about 387 acres in the Project Area would be clearcut on NFS lands. The clearcut treatments would occur as temporary openings until they regenerate back to forested stands. The individual size of the clearcut units would not exceed 40 acres. Certain large pine, snags, wildlife den trees, and other trees and shrubs

providing wildlife and visual values would be retained. The trees that are retained would help soften the visual open appearance of the temporarily open units. Aspen regenerates quickly and within approximately 5-10 years, the stands would have closed canopies, and in about 20+ years, tree heights approach the original stands. The aspen clearcut treatments improve age class diversity, help maintain the aspen forest type, and provide early successional wildlife habitat. The Forest Plan (page B-10) specifies that clearcutting is the optimum method for aspen regeneration.

Five upland openings are proposed to be maintained using prescribed burning. Conducting this treatment would prevent the encroachment of tree species, stimulate the growth of upland opening vegetation, maintain the units in a non-forested condition, and improve wildlife habitat. Opening improvement, using chemical, mechanical, hand maintenance, and prescribed burning are acceptable methods, as stated in the Forest Plan (page II-34).

Alternative 3

The amount of temporary openings created by clearcutting under this alternative would be reduced from about 387 (Alternative 2) to about 267 acres under this alternative. Under Alternative 3, no large temporary openings or aspen clearcutting would occur in Compartment 404. The aspen units that are not harvested would eventually convert to hardwood stands through natural succession and the aspen component in these units would eventually be lost. The effects of the aspen clearcut treatments and creation of temporary openings would be similar to those discussed under Alternative 2.

Under Alternative 3, no prescribed burning is proposed for the five upland openings (that would be burned under Alternative 2) to address the concern identified for burning openings. However, these openings would receive other maintenance activities, including brushing, mowing, snag creation, and pruning apple trees. Although the proposed mowing and brushing would maintain the existing openings, they are not as effective as prescribed burning in stimulating the growth of native vegetative species.

Alternative 4

The amount of temporary openings created by clearcutting under this alternative would be reduced from about 387 (Alternative 2) to about 360 acres. Under Alternative 4, five aspen clearcutting units proposed in Compartment 404, as compared to seven under Alternative 2. The two aspen units located in Compartment 404 closest and most visible to the landowners concerned about the treatments would not occur. The aspen units that are not harvested would eventually convert to hardwood stands through natural succession and the aspen component in these units would eventually be lost. The effects of the aspen clearcut treatments and creation of temporary openings would be similar to those discussed under Alternative 2.

The amount of opening prescribed burning would be reduced under this alternative. Under this alternative, three openings would receive a prescribed burn treatment to maintain the opening, as compared to five under Alternative 2. The openings selected to be burned are considered the highest priority because of their vegetative composition. The openings that would not be burned would receive other maintenance activities, including brushing, mowing, snag creation, and pruning apple trees. Although the proposed mowing and brushing would maintain the existing openings, they are not as effective as prescribed burning in stimulating the growth of native vegetative species.

Cumulative Effects

The area of analysis for cumulative effects is the National Forest System lands where clearcuts and opening improvements would occur, because impacts of these activities are generally restricted to treatment sites and impacts from agricultural, residential, and forestry practices across adjacent public and private lands are not expected to be measureable. The timeframe of 10 years was used for cumulative effects.

Table 3-1 displays the amount of clearcutting and opening maintenance that occurred on NFS lands within the Project Area over the last decade and what is proposed in the Marilla Too Project. The total amount of clearcutting and opening maintenance that have occurred on NFS land added to what is proposed is less than 1% of entire the Project Area.

Table 3-1: *Acres of Aspen Clearcut and Opening Maintenance Treatments Conduced on NFS Land within the Project Area 2000 – 2010

	Clearcut	Opening Maintenance	TOTAL
Acres of Treatments within Project Area Between 2000-2010	325	62	387
Maximum Acres of Treatments Proposed in the Marilla Too Project	387	255	642
Total Acres	712	317	1029
Percent Of Project Area	.05%	.02%	.08%

*Percentages for Existing conditions derived from GIS

Aspen clearcutting would continue in the future on NFS lands. This practice would continue to create temporary openings, would maintain the aspen forest type, and improve aspen age class diversity. Upland opening maintenance would also continue to occur across the Manistee National Forest in the next decade. This practice would keep these openings from converting to forested stands under natural succession.

Under Alternative 1, clearcutting, opening prescribed burning, and creation of temporary openings would continue outside the Project Area on National Forest System lands and clearcutting and agricultural treatments would continue on privately owned lands. The duration and magnitude of Alternative 2, 3, and 4 would incrementally add to past, present, and reasonably foreseeable actions, including clearcut and opening maintenance on NFS and private land.

CONVERSION OF FOREST TYPES

Existing Condition

This issue reflects the concern over the conversion of existing forest types to a different forest type as a result of the proposed treatments; including one overstory removal harvest, six red pine or hardwood stands proposed to be converted to aspen, and three white pine underplanting treatments. Approximately 1030 acres of red pine occur in the Project Area, including over 940 acres between ages 40 – 90. Approximately 200 acres of northern hardwood, over 4280 acres of mixed oak/upland hardwoods, and 2280 acres of red oak forest types occur on NFS land in the Project Area. These are the forest types that the overstory removal, aspen conversion, and white pine underplanting treatments are proposed.

Direct and Indirect Effects

Alternative 1

Under Alternative 1, no overstory removal, aspen conversion, white pine underplanting, or other management activities associated with this project would occur in the Project Area on NFS lands. Vegetative conversions towards mature forest types would take place over time as natural succession occurs. Slight visual changes are expected within the next decade as some mature trees die from wind, disease, and insect damage. Local environmental events (e.g. wildfire, windstorms) would affect individual trees and small areas of forest land. The landscape of the area would remain influenced by natural events and would consist of a mix of forests and openland and low-density rural residential.

Alternative 2

Under Alternative 2, one overstory removal harvest unit is proposed for treatment. This unit was previously thinned in the 1990s. The overstory removal treatment would promote the existing oak, and red maple, and black cherry regeneration and convert the stand from red pine to a red pine/mixed oaks stand and improve vegetative and structural diversity.

Four red pine/hardwood units and two oak/aspen units would be converted to aspen. The red pine/hardwood stands proposed to be converted to aspen are small young stands that have an aspen component and are located adjacent to existing aspen stands or stands with an aspen component. The two oak units have a pronounced aspen component. Clearcuts would convert these units to an aspen forest type, increase the amount of early successional habitat, and improve wildlife habitat.

Three oak/hardwood stands are proposed to be underplanted with white pine. These stands were previously harvested in the late 1980 and early 1990s using the clearcut, shelterwood, or removal harvest methods. The underplanting would improve the vegetative and structural diversity of these stands.

Alternative 3

Under Alternative 3, no overstory removal treatments, aspen conversion, and white pine underplanting would occur in the Project Area. Therefore, no conversion of forest types would occur due to management actions. The vegetative and stand diversity of these units would not be improved.

Alternative 4

Under Alternative 4, no overstory removal treatments would be implemented. The vegetative and stand diversity of this red pine unit would not be improved.

Under this alternative no red pine/hardwood units would be converted to aspen, as compared to four under Alternative 2. However, two oak/aspen units would be converted to aspen, the same as under Alternative 2. This treatment would increase the aspen forest type in this area, increase the amount of early successional habitat, and improve wildlife habitat. This alternative reduces the amount of forest type conversion on NFS land.

One oak/hardwood stand would be underplanted with white pine as compared to three under Alternative 2. The underplanting would improve the vegetative and structural diversity of this stand.

Cumulative Effects

The area of analysis for cumulative effects is the National Forest System lands where forest conversions, including overstory removal, aspen conversion, and white pine underplanting would occur, because impacts of these activities are generally restricted to treatment sites and impacts from agricultural, residential, and forestry practices across adjacent public and private lands are not expected to be measureable. The timeframe of 10 years was used for cumulative effects.

Table 3-2 displays the approximate amount of overstory removals and tree planting that occurred on NFS lands within the Project Area over the last decade and what is proposed in the Marilla Too Project. The total amount of overstory removals and tree planting that have occurred on NFS land added to what is proposed is less than 1% of entire the Project Area.

Table 3-2: *Acres of Overstory Removals and Tree Planting Treatments Conduced on NFS Land within the Project Area 2000 – 2010

	Overstory Removal	Tree Planting	TOTAL
Acres of Treatments within Project Area Between 2000-2010	14	69	83
Maximum Amount of Treatments Proposed in the Marilla Too Project	40	88	128
Total Acres	54	157	211
Percent Of Project Area	.00%	.01%	.02%

*Percentages for Existing conditions derived from GIS

These treatments are likely to continue in the next decade in order to improve vegetative and structural diversity and to sustain forest health. The duration and magnitude of Alternative 2 and 4 would incrementally add to past, present, and reasonably foreseeable actions, overstory removal, underplanting, and stand conversions on NFS and private land. Alternative 1 and 3 and on privately owned lands, conversion of forest types would continue with natural forest succession or activities occurring on private lands.

Other Issues and Management Concerns

VEGETATIVE COMPOSITION

Existing Condition

The forest cover types of the Project Area are dominated by oak, aspen, red and white pine. Jack pine, lowland hardwood, lowland conifer, and non-forest upland openings are less frequent in the Project Area. The red, white, and jack pine plantations were primarily planted 40 to 80 years ago. The majority of non-forested areas are upland openings, usually in valley bottoms or on abandoned pasture, where tree encroachment occurs more slowly. Age classes greater than 100 years are few for two reasons: (1) the original hardwood forests were removed between 1910 and 1930, and (2) because pines were planted on abandoned agricultural lands when the properties were incorporated into the Manistee National Forest. The current age class distribution by forest type is displayed in Table 3-3: Acres of Forest Types by Age Class, 2010.

The vertical structure of the existing vegetation is predominantly even-aged, dominated by mixed oaks, red maple, black cherry, and beech; most trees having similar diameters, heights, and ages in any particular stand. Seedlings and saplings are numerous in some locations. The shrub and herbaceous layers are dominated by witch hazel, viburnum, juneberry, beech, and maple regeneration, bracken, and a variety of herbaceous species in the understory of forested stands. Non-forested uplands usually have blackberry, raspberry, sumacs, bracken fern, and sedge/grass species. The few lowland forest areas are dominated by red maple, ashes, aspen, and northern white cedar in the overstory; dogwoods, viburnums, bunchberry, wintergreen, cattails, and ferns are common understory and ground vegetation species. Non-native shrub and herbaceous species have become established, especially in locations repeatedly disturbed by harvesting and road maintenance activities. Non-native invasive plants (NNIP) are discussed in the following NNIP section.

Table 3-3: *Acres of Forest Types by Age Class, 2010 (NFS Land Only)

	Age Class												
	0 -10	11-20	21-30	31-40	41-50	51 -60	61-70	71-80	81-90	91-100	100+	None	
Forest Type													Total
Red and White Pine		91			21.8	105	426	374	16.6				**1034**
Jack Pine - Oak		14		22.8			31.9	90.2					**159**
Red Pine - Oak							231	148		16.7			**395**
Northern Hardwoods						32.5		19.8	30.1	103.2	17.8		**203**
Mixed Lowland Conifer		31	81.4			9				112.2	113		**347**
Black and White Oak				11.9						36.8	224.2		**273**
Northern Red Oak	33	53			44.7				246.4	706.7	1199		**2283**
Mixed Oak/Upland Hardwoods	4.8	287	357	473	636	51.9		5.3	993.2	618.1	853.4		**4278**
Mixed Lowland Hardwoods			32.1						16.5	136.5	108.9		**294**
Quaking/Bigtooth Aspen	319	379	843	1034	312	306	13.1	29.6	194	16.2			**3446**
Upland Opening/Lowland Brush												436	**436**
Total	**357**	**856**	**1313**	**1542**	**1014**	**504**	**702**	**667**	**1497**	**1746**	**2516**	**436**	**13,147**

* = GIS acres used for age class table estimates

The Forest Plan provides vegetation composition objectives for 2016 (after the first decade), based on natural capability of the land, for the desired amounts of vegetation classes on all Manistee NFS lands. These amounts are displayed in Table 3-4: Desired, Existing, and Project Area Vegetation Composition Objectives. The age class tables, Project Area acreage, and vegetative treatment acres have been derived from GIS information and/or the FACTS database. Slight variations in acreage estimations may exist.

Table 3-4: Desired, *Existing, and *Project Area Vegetation Composition Objectives

Vegetation Class	Forest Plan Desired in 2016 (Manistee NF after first decade)	Manistee NF Existing	Project Area Existing 2010
Aspen/Birch	10-16%	13%	26%
Barrens & Savannahs	2-5%	N/A	N/A
High-Site Oaks	15-21%	18%	50%
Lowland Conifers	0-5%	2%	3%
Lowland Hardwoods	4-10%	8%	2%
Long-Lived Conifers	17-23%	21%	11%
Low-Site Oaks	13-19%	16%	2%
Northern Hardwoods	8-14%	10%	2%
Openings	4-10%	7%	3%
Short-Lived Conifer	2-8%	5%	1%

*Percentages for Existing conditions derived from GIS

In comparing the Forest Plan vegetation composition objectives to the existing condition within the Project Area, the following vegetation classes within the Project Area are:

- Under-represented: Barrens and Savannahs; Lowland Hardwoods (red maple and ashes); Long-rotation Conifers (red and white pines); Low-Site Oaks; Northern Hardwoods (sugar maple, beech, and yellow birch); Openings; and Short-Lived Conifers (jack pine).
- Appropriately represented: Lowland Conifers (northern white cedar and tamarack).
- Over-represented: Aspen/Birch, High-Site Oaks (northern red oak).

Barrens and savannahs and short-lived conifers are not represented and are not suitable vegetation types for the Project Area as soils and topography are not supportive of these vegetation types. Lowland Hardwoods (red maple and ashes); Low-Site Oaks; Northern Hardwoods (sugar maple, beech, and yellow birch) are under-represented because of unsupportive site characteristics, plus a historical absence or minimal management for these vegetation types.

Direct and Indirect Effects

Alternative 1

No project activities would occur as a result of this alternative; therefore, this alternative responds to those individuals who were concerned about the proposed vegetative treatments. No action would be taken to commercially thin, regenerate, or non-commercially treat aspen, pine, or hardwood stands. The dominant overstory vegetative types and associated tree species would change modestly in the Project Area over the next decade due to natural succession, baring a large scale natural disturbance or wildfire.

During the next 10 – 20 years, long-lived conifers (red and white pines) and aspen would continue to mature. Mixed oaks/upland hardwood species, especially red maple, would increase as these species accrue in the understory due to shade, and reduce the chances for pines to compete for future growing space. Low-site oaks would remain at existing levels or increase slightly, as short-lived conifer (jack pine) mortality create opportunities for the oaks to increase in numbers and size, and thus displace jack pine. The other vegetative groups would remain at current levels, limited by the physical capability of the land to grow and sustain these groups. Individual tree growth and survival, and forest succession, would be subject to environmental and biological factors. Trees would continue to compete for sunlight, water, and nutrients. The infestation risk of pathogens would increase as tree vitality decreases. The opportunity for NFS land timber product harvesting, especially from aspen and red pine areas, would be transferred to other suitable locations.

The other longer-lived species, such as northern red oak, red maple, white cedar, and sugar maple, while maturing, would tend to persist as even-aged groups of these species and their associates. Aspen, jack pine, and black/white oak stands would be represented by a smaller range of age classes, as older age areas decline and occupy smaller patch sizes. The population of red and white pines and oaks in large tree sizes would remain relatively stable. However, seedlings and saplings of these species would increase as they encroach on upland openings, where aspen and jack pine stands decline, and in previously thinned pine plantations. The population of ash species of all ages and would decline dramatically as the emerald ash borer infestation spreads throughout the Project Area.

Openings would decrease in size and abundance primarily due to encroachment by oaks and pines. Small upland openings would become fully stocked, mainly with oaks, while larger openings would become smaller in size due to tree encroachment on their perimeters. Under this alternative, vegetative diversity within these areas would decrease as plants that prefer open conditions would slowly be replaced by species that prefer shadier conditions. Non-native plants would persist adjacent to roads and in open and other disturbed areas, and become established where natural and human disturbances provide new habitat opportunities.

Approximately 1,150 acres on NFS land within the Project Area are included in the HMNF's old growth design. No vegetative treatments are proposed in this project within the old growth design. Stands within the old growth design would continue to mature through natural forest succession.

Alternative 2

The majority of the Project Area is located within MA 2.1 G and 4.2 G within the Marilla Grouse Management Area. Although the aspen/birch vegetation type is over-represented in the Project Area, it is under-represented across the Manistee National Forest (see Table 3-4). Forest Plan direction for grouse management areas specifies an objective to manage intensively to provide quality grouse habitat, and maintain or increase the acres of aspen/birch in grouse management areas. Therefore, approximately 387 acres of aspen is proposed for harvest and natural regeneration under Alternative 2. A clearcut (removing 95% of all trees greater than 5 inches in diameter) would be used to further regenerate aspen, and trees between 1 and 5 inches in diameter would be non-commercially treated to further promote natural regeneration. This treatment would modify species composition, reducing the numbers of non-aspen woody species and promoting numerous shade intolerant shrub and herbaceous species. Within the first decade the canopy layer would become 5 – 15 foot tall aspen root suckers and sprouts of oaks and other hardwood trees; supplemental oak and conifer seedlings would be hand planted where adequate natural stem densities are not obtained.

Four red pine/hardwood units and two oak/aspen units would be converted to aspen by clearcutting under this alternative. These aspen clearcuts would convert these units to an aspen forest type, increase the amount of early successional habitat, and improve wildlife habitat. The aspen clearcut treatments would help achieve the project's objective of providing early successional habitat, maintaining the aspen forest type, and improving aspen age-class diversity. This treatment would also help achieve the Forest Plan's desired vegetation composition objectives for aspen/birch on the Manistee National Forest after the first decade (see Table 3-4).

Thinning and overstory removal treatments are proposed red pine stands in the Project Area. These treatments would help achieve the Forest Plan's desired Vegetative Composition for long-lived conifers on the Manistee National Forest after the first decade (see Table 3-4) and would also help achieve the project's objective of sustaining forest and ecosystem health. Thinning red pine plantations would promote diameter growth of remaining trees for 15-20 years, and perpetuate the dominance of red pine in an even-age structure. Thinning would improve the growth of the residual trees, increase the timber value over the long-term, maintain tree vitality, decrease the risk from pathogen infestation, and promote understory vegetation growth. Mature oak, maple and other species, retained as individuals within these plantations, would provide some vegetative and structural diversity. One red pine unit (approximately 40 acres) would be treated using the overstory removal harvest. This treatment would encourage the rapid growth of existing oak and red maple regeneration and convert the stand from red pine to mixed oaks and change structural diversity within the oak vegetation types and improve age class diversity of long-lived conifers that are under-represented in the Project Area.

Three hardwood stands are proposed to be underplanted with white pine under Alternative 2. These stands were previously harvested in the late 1980 and early 1990s using the clearcut, shelterwood, or removal harvest methods. The underplanting would improve the vegetative diversity of these stands.

Openings are under-represented in the Project Area (see Table 3-4). Existing upland openings would be maintained using mechanical mowing, hand tool treatments, and prescribed burning. These treatments would reduce rate of encroachment of tree species, stimulate the growth of herbaceous vegetation, berry-producing shrubs, and soft mast producing trees for wildlife habitat diversity. Prescribed burning in the existing managed opening would be used to restore or stimulate growth of native herbaceous species and promote pollinator habitat. Prescribed burning in upland openings could also help to reduce infestations of non-native invasive plants. The opening maintenance treatments would help achieve the project's objective

of providing early successional habitat and also would help achieve the Forest Plan's desired vegetative composition objectives for the Manistee National Forest after the first decade.

A snag creation treatment is proposed in an unthinnned red pine stand would be completed by either girdling or felling the tops of trees and leaving a 10 – 20 foot tall portion to further decay. Creating snags in an unthinned red pine stand would improve cavity nester habitat while also opening the canopy of the red pine stand, stimulate understory vegetation and improve vegetative and habitat diversity.

Alternative 3

The principal differences between Alternative 3 and Alternative 2 are:

- Amount of aspen regenerated with clearcut treatments is reduced
- Amount of red pine/hardwood or oak/aspen areas converted to aspen is eliminated
- Amount of red pine treated with overstory removal is eliminated
- Amount of opening maintenance, including prescribed burning larger-sized openings is reduced
- Amount of snag creation is eliminated
- Amount of non-native invasive plant treatments is reduced
- Amount of white pine underplanting is eliminated

The effects on vegetative composition described under Alternative 2, other than scale and location and fewer treatment, are similar under Alternative 3. This alternative would result in less early successional habitat being maintained as compared to Alternative 2.

Under Alternative 3, the overstory removal harvest is not proposed to address the concern raised with this treatment. Eliminating this treatment would not promote the establishment of hardwood regeneration and improve vegetative and structural diversity as quickly as if this treatment were not implemented.

Under Alternative 3, no prescribed burning is proposed for the five upland openings (that would be burned under Alternative 2) to address the concern identified for burning openings. However, these openings would receive other maintenance activities, including brushing, mowing, snag creation, and pruning apple trees. Although the proposed mowing and brushing would maintain the existing openings, they are not as effective as prescribed burning in stimulating the growth of native vegetative species and promoting pollinator habitat.

Under Alternative 3, the snag creation in one small red pine stand and the white pine underplanting treatment would not be conducted. Vegetative and habitat diversity would not be enhanced in these areas.

Alternative 4

The principal differences between Alternative 4 and Alternative 2 are:

- Amount of aspen regenerated with clearcut treatments is reduced
- Amount of red pine/hardwood converted to aspen or openings is eliminated
- Amount of red pine treated with overstory removal is eliminated
- Amount of opening maintenance, including prescribed burning larger-sized openings is reduced
- Amount of non-native invasive plant treatments is reduced
- Amount of white pine underplanting is reduced

The effects on vegetative composition described under Alternative 2 and 3, other than scale and location and fewer treatments, are similar under Alternative 4.

Culmination of Mean Annual Increment: Alternatives 2, 3, and 4

The stands proposed for regeneration treatments (clearcut and removal) comply with the National Forest Management Act of 1976, Section 6 (m), requirements that prior to harvest, stands of trees shall generally have reached (95%) of the culmination of mean annual increment (CMAI, cubic foot measurement), or there is a project specific exception to this requirement (NFMA 1976). Except for the stands listed in Table 3-5: Project Specific Exceptions to CMAI for Alternatives 2, 3, and 4, this requirement is met, as documented on the silvicultural prescriptions and growth and yield analysis.

Table 3-5: Project Specific Exceptions to CMAI for Alternatives 2, 3, and 4

Compartment	Stand	Species Group	2009 Age	CMAI year/ft^3/ac/yr	Reason to Regenerate
404	20	Aspen	39	2010/71.8	Grouse habitat
404	22	Aspen	39	2025/56.2	Grouse habitat
404	24	Aspen	39	2035/51.6	Grouse habitat
411	2	Aspen	44	2010/50.8	Grouse habitat
411	12	Aspen	38	2040/35.5	Grouse habitat
411	21	Aspen	40	2045/40.2	Grouse habitat
412	1	Aspen	44	2025/40.2	Grouse habitat
412	8	Aspen	45	2035/48.5	Grouse habitat
412	27	Aspen	45	2040/48.3	Grouse habitat
412	31	Aspen	54	2010/56.9	Grouse habitat
412	37	Red Pine	77	2060/44.9	Oak age class diversity
413	5	Aspen	42	2010/87.4	Grouse habitat

The Forest Plan sets rotation guidelines for aspen between 40 – 60 years, and red pine between 70 – 120 years; exceptions are permitted to provide for other integrated resource objectives (Forest Plan page II-17 and Table D-4 page D-3). A primary objective of the Marilla Too Project is to maintain the aspen component in commercial forest stands and provide younger aspen age classes. Another primary objective of the Project is to manage red pine stands to increase the infiltration of sunlight, reduce competition, and promote the regeneration of red, black and white oak seedlings.

Cumulative Effects of All Alternatives

The area of analysis for cumulative effects on vegetation is the Manistee National Forest, including State of Michigan and private lands within its proclaimed boundary. This large area represents locations where manipulation of similar forest ecosystems, in response to market and non-market forces, affects current and future forest vegetation patterns. District GIS and FACTS database records show that between 2000 and 2010 a variety of vegetation treatments on NFS lands within and adjacent to the Project Area have occurred. These treatments are summarized in Table 3-6 and 3-7:

Table 3-6: *Acres of Vegetation Treatments Conducted within the Project Area 2000 – 2010 (NFS Land only)

	Timber Harvest Activities						Wildlife Activities		NNIP Actions
	Clearcut	Thinning	Overstory Removal	Shelterwood	Tree Planting	Release (TSI)	Opening Mtc.	Snag Creation	
Total	325	158	14	76	69	73	62	286	5

* = FACTS acres used for age class table estimates

Table 3-7: *Acres of Vegetation Treatments Conducted within Compartments Adjacent to the Project Area 2000 – 2010 (NFS Land only)

	Timber Harvest Activities						Wildlife Activities		NNIP Actions
	Clearcut	Thinning	Overstory Removal	Shelterwood	Tree Planting	Release (TSI)	Opening Mtc.	Snag Creation	
Total	48	226	0	0	0	36	16	0	33

* = FACTS acres used for age class table estimates

Appendix D of the Forest Plan, Proposed and Probable Practices, displays an estimate of proposed and probable silvicultural treatments for the period between 2006 – 2026 in Tables D-4 and D-5. These projections have cumulative effects on the Forests' vegetation composition objectives over the next decade. Large areas of the National Forest would not be subject to active vegetation management. Together with the combined acres of projected thinning, regeneration harvests, and opening improvements, a desired vegetation composition (as displayed in Table II-3, page II-7 of the Forest Plan) is projected for 2016.

The principle effect of Alternative 1 would be to slowly shift the structure of individual and aggregate forested stands from even-aged to uneven-aged canopies. This would occur as the number of long-lived species such as maple and beech increase, and the number of red pine, oaks, and aspen decrease. The upland, non-forested areas would continue to be invaded with pines and oaks, and gradually attain forest qualities as these species mature and continue to regenerate in open areas. Infrequent insect, fire, and wind-induced mortality events would interact with, and result in, succession at a local scale (i.e. one to several acres, and less frequently, at scales larger than 10 acres), especially in jack pine, lowland and riparian forests. The long-term exclusion of fire disturbance would enhance these effects, and favor accumulating those species tolerant of less frequent fires (maples and small diameter beech) over those species adapted to more frequent fire events (red pine, oaks, and aspen). Ash species are likely to decline severely because of the un-constrained spread of the emerald ash borer, which kills white, green and black ash trees within a few years of becoming infested. American beech trees in diameters greater than 12" are likely to decline, although at a lower rate than ash species, because of the un-constrained spread of beech bark disease, which leads to mortality by within 15+ years of becoming infested. The dominant shrub and herbaceous species would persist.

Alternatives 2, 3, and 4 contribute to achieving the Forest Plan's desired condition and the HMNF's timber outputs and helping achieve the desired vegetative composition over the next decade. The expected level of vegetation treatments on NFS lands in future decades would most likely increase for red pine thinnings, mature forest regeneration, development of non-forested habitat areas, and dead tree salvage as the emphasis on fuel reduction projects increases (Forest Plan, Tables D-4 and D-5). There would likely be additional silvicultural and habitat improvement treatments in and near the Project Area in the reasonably foreseeable future. Future thinning treatments would be implemented at approximately 15 to 20 year intervals. Upland opening and stand improvement activities would continue to be implemented, depending on site-specific conditions. The combined vegetative treatments that have occurred and are planned in the area, in conjunction with the proposed activities would improve vegetative diversity and would continue to improve age class diversity in the Project Area and across the HMNF.

Past, present, and future foreseeable actions would improve the growth of the residual stands, increase the timber value over the long-term, increase tree vitality, decrease risk from pathogen infestation, improve wildlife habitat for early successional species, and promote the understory vegetation growth. The treatments would achieve the project's objective of sustaining forest health and vegetative diversity.

The principle effect of Alternatives 2, 3, and 4 would be to retain the even-age structure of individual and aggregate forest areas where the tree cutting treatments in Table 2-1, page 2-13 occur during the period 2010 – 2020. Within the analysis area, species such as red and white pines, oaks, and aspen remain common and dominant within individual stands. Ash species are likely to decline severely because of the

un-constrained spread of the emerald ash borer, which kills white, green, and black ash trees within a few years of becoming infested. American beech trees are likely to decline, because of the unconstrained spread of beech bark disease which leads to mortality within 15+ years of becoming infested. A small increase in the population of long-lived lowland conifers and shrubs would occur via future riparian tree and shrub planting.

The use of fire in managed openings would reduce pine, oak, and maple encroachment, and promote the establishment of a more diverse, native, herbaceous flora. These herbaceous species would become established through seed bank stimulation and/or direct seeding, and become self-sustaining.

Fewer acres of private lands in the analysis area receive equivalent vegetation treatments because fewer acres are in timberland. The most common activity on private lands would likely be mature hardwood and dead tree salvage harvesting, and conversion to other than commercial forest uses (MDNR 2006a). New residential and commercial structure building on the private land base, and conversion of timberlands would change the amount of total forest cover (Ibid).

Conclusion: The duration and magnitude of no action would incrementally add to past, present and reasonably foreseeable vegetation patterns within the Manistee National Forest, primarily by allowing existing vegetation to mature or be replaced by late-seral stages of forest vegetation. This effect would be most pronounced on NFS lands; private forest lands are expected to shift towards mature oak forests.

The duration and magnitude of Alternatives 2, 3, and 4 would incrementally add to past, present, and reasonably foreseeable vegetation patterns within the Manistee National Forest, primarily by maintaining existing non-forest lands, regenerating some mature red pine, oak, and aspen forests, by leaving other northern hardwood, jack pine, and aspen forested areas to mature or be replaced by late-seral stages of forest vegetation, and by thinning red pine plantations. These effects would be most pronounced on NFS lands; private forest lands are expected to shift towards mature, low-density oaks, and lowland hardwood forests. Upland opening conditions on NFS lands would increase; non-forest private lands would remain stable or increase, dominated by residential, pasture and agriculture uses.

NON-NATIVE INVASIVE PLANT SPECIES

Existing Condition

Comments were received expressing concerns about the non-native invasive plant (NNIP) program, especially regarding elimination of autumn olive, Scots pine, and non-native honeysuckles. This section will address these concerns.

The Huron-Manistee National Forests have identified certain plants as non-native invasive plant species NNIP). Each NNIP species has a priority ranking for treatment. The management of non-native invasive species is important because they have the capacity to alter or dominate native communities and easily become established in areas that are frequently or severely disturbed, such as roadsides, landing sites, and skid trails. They can then spread from these disturbed sites into the surrounding habitats and disrupt the ecology of natural communities. Non-native invasive plants can reduce biodiversity, alter the environment they invade, and impact wildlife, plants, and people.

Table 3-8 below lists the NNIP proposed for treatment, the Forest NNIP treatment priority, and the recommended management options. Treatment recommendations for each NNIP, unit, and alternative are located in the Treatment Unit Descriptions in Appendix A and in the Planning Record.

Table 3-8: Non-Native Invasive Plant Treatment Recommendations

NNIP Species	Forest Priority(1)	Management Options	Number of Units(2) of NNIP Treatments	Recommended Treatment
Bull thistle	4	Prevent invasion	4	Herbicide
Thistle species	4	Prevent invasion	10	Herbicide
Common burdock	3	Control source populations, eradicate outliers	2	Herbicide
Wild parsley	3	Control source populations, eradicate outliers	3	Herbicide
Autumn olive	4	Prevent invasion	19	Herbicide
Honeysuckle	2	Eradicate	3	Herbicide
Black locust	3	Control source populations, eradicate outliers	1	Herbicide
Common lilac	3	Control source populations, eradicate outliers	1	Herbicide
Scots pine	4	Prevent invasion	2	Mechanical control

(1)-Ratings of Forest Priority are levels that determine the need to focus treatment attention on either controlling or eradicating the NNIP. This rating takes into consideration such factors as current presence on the Forest, potential of spread, and desired habitat characteristics.
(2)- It is possible that the number of units and area of infestation would be slightly larger by the time treatment occurs due to movement and increased infestation between the time when surveys were conducted and when treatment activities occur.

Nine NNIP species identified in proposed treatment locations with Forest Priority 2, 3, or 4 are proposed for control treatments (see Table 3-8). The recommended NNIP control treatments were considered the most effective and cost efficient control measures for the specific NNIP found in the proposed activity locations. Autumn olive, non-native honeysuckle, bull thistle, thistle species, common burdock, hedge parsley, black locust, and common lilac are proposed to be treated with herbicides because it is the most effective treatment for controlling these species. Scots pine has the potential to be effectively controlled without herbicide so it would be treated mechanically by cutting.

The management of non-native invasive species is important because they have the capacity to alter or dominate native communities and easily become established in areas that are frequently or severely disturbed, such as roadsides, landing sites, and skid trails. They can then spread from these disturbed sites into the surrounding habitats and disrupt the ecology of natural communities. Non-native invasive plants can reduce biodiversity, alter the environment they invade, and impact wildlife, plants, and people.

NNIP can alter their environment by changing hydrology, soil chemistry, and fire regimes. They impact wildlife species by causing direct mortality, decreasing available food supplies, providing nutritionally inferior food, and poisoning or repelling insects. They impact other plant species by competing for water, sunlight, nutrients, space, and pollinators; producing allelopathic compounds and disrupting mycorrhizal relationships; diluting gene pools through hybridization; causing declines in the growth rates of canopy trees; preventing natural tree regeneration; and displacing native plants. They also impact people by impeding industry, disrupting agriculture, endangering human health, degrading recreational experiences, and costing billions of dollars for treatment every year (Tallamy 2007).

Non-native plants fail to support the insect diversity and biomass that native plants do. Most insects cannot or will not eat non-native plants. About 90% of herbivorous insects are specialists and will only feed on a few plant lineages. The remaining 10% of herbivorous insects are able to feed on multiple species and may adapt to a non-native species if it is similar enough to their host plants. Unfortunately, many non-native plants are not closely related to any species in North America, making it unlikely that native insects will be able to use those species anytime soon (Tallamy 2007). Preliminary study results indicate that native woody plants and vines support far more insect species and biomass than non-natives. Comparisons of Lepidoptera and sawfly caterpillar use of native versus non-native woody plants indicate that the natives support 35 times more insect biomass. Since Lepidoptera and sawfly caterpillars are the largest component in the diets of insectivorous birds, this decline in caterpillar biomass could impact these species as well (Tallamy 2007). As non-native plants displace native plants, fewer insects will be available to other members of the food web, causing a ripple effect throughout the animal community.

Autumn olive

Autumn olive occurs in the Project Area in disturbed areas, early-successional fields, pastures, landings, and roadsides. Once established, it can eliminate almost all other plant species and interfere with the growth and germination of desirable species. It has the potential to form monocultures, which only produce berries for a brief period of time, while a native plant community consisting of multiple species produces food over a much longer period of time. Originally planted for its perceived benefits to wildlife, it has since spread throughout Michigan and other states via bird feces. The Nature Conservancy (Sather and Eckardt 1987) notes that autumn olive has the potential of becoming one of the most troublesome invasive shrubs in the central and eastern United States due to its prolific fruiting, rapid growth, wide dissemination by birds, and its ability to easily adapt to many sites. In addition, because it fixes nitrogen in the soil, it can disrupt native plant communities that require less fertile soil (Czarapata 2005). Stump treatment has been shown to be effective in controlling autumn olive. Glyphosate has been effective in controlling autumn olive when used as a 10-20% solution and applied directly to the cut stump. Although the product label specifies a higher concentration for cut-stump application (50-100%), this lower concentration has proven effective (Szafoni 1990).

Non-native Bush Honeysuckles

Non-native honeysuckles are becoming increasingly common throughout the Project Area. Honeysuckles out-compete native plants because they grow relatively quickly, leaf out earlier in spring than native plants, and deplete the soil of moisture and nutrients. Some exotic honeysuckles may also be allelopathic (Czarapata 2005). The Nature Conservancy (Sather and Eckardt 1987) has also found that desired forest regeneration can be severely impeded by these species. In addition to their impact on understory plants, at least one non-native bush honeysuckle, Amur honeysuckle (*Lonicera maackii*), can reduce the growth rate of overstory trees (Hartman and McCarthy 2007). Most natural communities are at risk of being invaded by non-native honeysuckles, but open woods are the most affected and are particularly vulnerable if the site has been disturbed (Czarapata 2005). Non-native bush honeysuckles also have a negative impact on wildlife species. Studies have shown that robin and wood thrush nests suffered a much higher rate of predation if they were built in non-native honeysuckle and buckthorn shrubs than in similar native shrubs such as hawthorn and viburnums. Researchers have also noted that the yellow feathers of some cedar waxwings, white-throated sparrows, Kentucky warblers, and yellow-breasted chats are being replaced with orange feathers. Laboratory studies demonstrated that if cedar waxwings were fed honeysuckle berries while they were molting, they grew orange tail feathers. Since color is critical to the social behavior and interaction of birds, the impacts of non-native honeysuckles on color variation could have adverse effects on many bird species (Czarapata 2005).

A survey of The Nature Conservancy land managers undertaken in 1998 found that most used glyphosate as a cut stump treatment to control non-native invasive honeysuckles. For cut stump treatments, 20-25% solutions of glyphosate can be applied to the outer ring (phloem) of the cut stem. A 2% solution of glyphosate can be used for foliar treatments late in the growing season. Cut stump treatments should occur

from late summer through the dormant season (Sather and Eckardt 1987). Effective mechanical management requires a commitment to cut or pull plants at least once a year for a period of three to five years because honeysuckle stumps resprout vigorously if they are not treated with an herbicide (Sather and Eckardt 1987). Any portion of the root that is not removed has the potential to sprout (Batcher and Stiles 2000). In small, easily accessible infestations, honeysuckle can be controlled by cutting them several times a year for at least two years, until the plant's root stores are depleted and it dies. Honeysuckles keep their leaves later in the fall than native shrubs, making it easier to spot treat them at that time (Czarapata 2005). The flush of seedlings that germinate after removal of the larger shrubs must also be controlled (Batcher and Stiles 2000).

Scots Pine

Scots pine predominantly invades open areas that have undergone some disturbance, such as roadsides and old fields. In Ontario it has reportedly invaded bogs. It also invades woodlands where there is a seed source. Given its preference for open, dry, sandy sites it may threaten barrens and savanna habitat. It can attain sexual maturity at 5-8 years of age, but usually from 10 to 15 years. This early ability to reproduce is probably a contributing factor in its invasiveness. Scots pine generates a significant amount of needle litter, which can impact nutrient cycling in the open areas it invades, since these areas usually had not contained pines previous to the invasion of Scots pine (Sheehan 2007). Where Scots pine has been intermixed with white or red pine, its aggressive early growth crowds out the roots of the other species, leaving only Scots pine (USDA Forest Service Weed of the Week 2006). Scots pine would be treated in two upland openings in the Project Area because Scots pine seedlings would likely spread, encroach on the existing openings, contribute to the gradual loss of grasses, forbs, and shrubs, and then convert to a forested stand. Mechanical treatment has proven effective in controlling Scots pine (Sheehan 2007, USDA Forest Service Weed of the Week 2006).

Other Non-native Invasive Species

Bull thistle, thistle species, common burdock, hedge parsley, black locust, and common lilac are also proposed for control and would be spot-treated with glyphosate.

Direct and Indirect Effects

Alternative 1

Under Alternative 1, no NNIP treatments would occur. NNIP species would continue to expand in population size, especially in areas adjacent to roadways and other areas of disturbance. The existing forest road system would remain in place so the threat of new introductions and spread of existing NNIP would continue at current levels or increase with the level of disturbance. New NNIP infestations would likely occur. The existing infestations would go unchecked and the area occupied by native plants in the Project Area would decline over time as NNIP species replace native plants and alter natural ecosystems. The diversity of native insects would likely decrease with the decline in native plant prevalence (Tallamy 2007). At some point, an invasive species' population could reach a level at which it would no longer be feasible to eliminate it from the Project Area. The consequence of unchecked NNIP spread in stands where Regional Forester's Sensitive species (RFSS) species are present would be the reduction and degradation of RFSS habitat due to invasive plant competition and modification of site conditions. Wildlife species and their habitat would also be impacted.

Alternative 2

Under Alternative 2, native plant prevalence in the Project Area would increase over time as NNIP species are controlled. The diversity of native insects and pollinators would also increase with the decline in NNIP species. Plant and animal habitat quality and biological diversity would be improved by controlling NNIP infestations.

Under Alternatives 2, 3, and 4 one new Forest System road would be constructed and remain open. This would result in a slight increase in the threat of new NNIP introductions because of the new soil disturbance. New temporary roads would be constructed to improve access to timber harvest units; however, these roads would be closed after the harvest operations are completed. Closing these roads would reduce the potential for new NNIP infestations to become established. The proposed road reconstruction would improve access to the treatment units; however, it would result in an increase in the threat of new NNIP introductions due to soil disturbance.

Mechanical cutting is proposed for the two Scots pine locations. This technique would likely be effective because the infestations are relatively small and this species does not root sprout. This treatment would result in decreasing the presence and spread of this NNIP species and promote native plant growth.

Treatment of the other eight NNIP species would involve using glyphosate in the cut-stump, spot spraying, or injection methods. These methods minimize the amount of herbicide used as well as the potential for accidental application to non-target species. Approximately 8.8 acres and 8 NNIP species are proposed for herbicide treatment; however, this is the approximate area of NNIP infestation. The actual herbicide application would only be applied to the stumps, stems, or foliage of the NNIP species controlled to minimize the amount of herbicide used and minimizes the potential for herbicide application to non-target species. Therefore, the actual area of herbicide application is much less than the approximate acreage of NNIP infestation. Re-treatments of these species would depend on the results found while monitoring the initial treatments.

Non-native invasive plant species identified in the Project Area would be treated using herbicide with the active ingredients in commercial formulations of glyphosate, including surfactants and adjuvants. To minimize the effects on human health, the guidelines and mitigation measures described in the Mitigation Measures section in Chapter 2 of the EA would be implemented. The effects of herbicide treatment would be: 1) the control or eradication of 8 NNIP species that are not currently well established in the Project Area; 2) the reduced spread of these NNIP species to non-infested locations in the Project Area (reduce source populations); and 3) the decreased loss of available habitat for native flora. Native berry-producing shrubs would be planted in stands where autumn olive and honeysuckle are removed to provide a wildlife food source. Other stands containing NNIS plant species within the Project Area would be treated as they are detected.

The NNIP species that were selected for treatment are those that are either not yet widespread throughout the Forest or have the potential for the biggest negative impact on native plant communities. Other NNIP were identified in the Project Area during field surveys and are of concern, but due to their local population characteristics, do not warrant direct suppression or eradication efforts. Timber harvest activities and moving heavy equipment around the National Forest have the potential to spread NNIP species. However, to minimize the risk of introducing them into other areas and to reduce their spread between infested and non-infested areas, equipment cleaning prior to use on National Forest System lands is recommended. Equipment cleaning may be required before equipment is moved between different harvest units depending on NNIP species present. Equipment cleaning consists of removing seeds, soil, vegetative matter, and other debris that could contain or hold seeds. This information can be found in the Planning Record.

Alternative 3 and 4

These alternatives reduce the acres and number of units and of NNIP control and reduce the stands where autumn olive, honeysuckle, and Scots pine would be treated. Alternative 3 and 4 treats approximately 1.7 and 3.6 acres and 12 and 32 units respectively, as compared to 8.9 acres and 36 units under Alternative 2 (see Table 2-1, page 2-13). These alternatives would result in increased NNIP infestations as compared to Alternative 2. The units where NNIP control would occur would result in similar effects as those discussed under Alternative 2. The NNIP species and locations that are not treated would result in a loss of native species, species richness, and biodiversity and other similar effects as those discussed under Alternative 1.

Cumulative Effects for All Alternatives

The cumulative effects analysis area includes the Project Area and National Forest and private lands bordering the Project Area. This cumulative effects area was chosen because NNIP infestations likely occur on lands adjacent to the Project Area and these adjacent lands would act as sources for NNIP.

Under Alternative 1, existing NNIP would colonize a larger percentage of the Project Area due to lack of NNIP treatment. New introductions of NNIP would likely become established, especially adjacent to roads and open areas on both public and private lands.

Major road corridors close to the Project Area would continue to bring visitors and vehicles into this area and promote the spread of invasive species. The Forest Service would continue to monitor and treat NFS lands within the Project Area to inhibit the spread of those NNIP of concern; however, because of the recreational use, new invasive species introductions to the area would be likely.

The NNIP species identified in surveys of the Project Area are likely to spread and occupy more of the land base in the future, including both public and private lands. The Forest Service will continue to expand its partnerships with agencies and landowners whose property serves as a source of non-native invasive plant species to address the spread of invasive plant species. A cooperative weed council was established in 2005 to address garlic mustard. The Michigan Dune Alliance was established in 2004 to address the spread of baby's breath along the Lake Michigan shoreline and has since become concerned about additional species. Other efforts to control and eradicate NNIP plants are underway in areas such as Sleeping Bear Dunes in Benzie County, and land conservancy properties in Benzie, Leelanau, Manistee, and Grand Traverse Counties. Through these combined efforts and continued public education, there would be increasing control of NNIPs.

Private landowners may use mechanical and chemical means to reduce the presence of weeds on privately held properties. Non-native invasive plants would be treated using mechanical, manual, or herbicide control methods in other Project Areas across the Cadillac-Manistee Ranger District. In addition, the Forest has the ability to apply wide-scale, limited use, control measures to control and eradicate NNIP plants in high priority areas.

Under Alternatives 2, 3, and 4 the population of NNIP plants would be reduced; however, other species would continue to be introduced or distributed by natural or human vectors. New introductions of NNIP plants would have less opportunity to become established on NFS lands disturbed by harvest and prescribed fire treatments because of maintenance and restoration of native herbaceous ground cover, and because of equipment cleaning measures that reduce spread and distribution by vehicles and equipment. These procedures would not eliminate NNIP problems on private lands or adjacent to roads and open areas in the analysis Area. Public – private cooperative efforts, as described above would assist in slowing the spread of some target NNIP, i.e., garlic mustard, in the cumulative effects analysis area.

ENDANGERED, THREATENED, AND SENSITIVE SPECIES

Existing Condition

A Biological Assessment and Evaluation (BE) was prepared for the Marilla Too Project (Planning Record). The BE evaluated the effects of this project under all alternatives on federally listed or proposed species, designated critical habitat, and Regional Forester's Sensitive Species (RFSS) that may inhabit the Project Area or have suitable habitat present in the Project Area. A separate Biological Assessment was prepared for Alternative 4 (preferred alternative) to ensure compliance with provisions of the Endangered Species Act, as amended. The Biological Assessment was submitted to the U.S. Fish and Wildlife Service (FWS) for Section 7 Consultation. The FWS concurred with the determination of threatened and endangered species that may be present in the Project Area and concurred with the determinations for the Indiana bat.

Sensitive plant species were included in analysis for the Project Area if they had been documented within a county occupied by the Cadillac-Manistee Ranger District of the Manistee National Forest or if the Project Area was within the species' distribution in Michigan. If there were no records of a sensitive species within a county occupied by the Cadillac-Manistee Ranger District or if the Project Area was outside of the species' distribution, it was assumed that the species was unlikely to be present within the Project Area. In addition to field surveys for sensitive species within the proposed project area, several sources were checked to determine if a sensitive species had ever been documented in the area, including the Cadillac-Manistee ETS database, Michigan Natural Features Inventory database, and the Online Atlas of Michigan Plants (*http://herbarium.lsa.umich.edu/website/michflora/*).

Effects Common to All Alternatives

The BE documented the determinations of effects of the Marilla Too Project activities on proposed, endangered, and threatened species and critical habitat, and on RFSS by each alternative. Based on field surveys, survey records, and the analysis of the effects on federally listed endangered and threatened species, and Regional Forester's Sensitive Species, the following determinations were made:

Alternative 1

- Would have "no effect" on the Indiana bat.
- Would have no impact on the eastern pipistrelle, bald eagle, red-shouldered hawk, northern goshawk, cerulean warbler, whip-poor-will, red-headed woodpecker, Blanding's turtle, and wood turtle.
- Would have a negative impact on the golden-winged warbler.
- Would have a slightly negative impact on habitat for sensitive plant species that prefer open conditions (Missouri rock cress, ternate grape fern, Schweinitz's sedge, Hill's thistle, northern wild comfrey, Engelmann's spike rush, prairie smoke, butternut, small-headed rush, Vasey's rush, furrowed flax, dwarf bulrush, Alleghany plum, pine drops, toothcup, Torrey's bulrush, yellow ladies' tresses, and false pennyroyal).
- Would have a slightly positive impact on habitat for sensitive plant species that prefer more closed canopy conditions (Oneida grape fern, false-violet, Goldie's wood fern, white adder's mouth, Virginia bluebells, American ginseng, bog bluegrass, and Canada yew).

Alternative 2

- Any potential direct and indirect effects on Indiana bats are expected to be insignificant, discountable, or beneficial. Thus, the alternative "May Affect, Not Likely to Adversely Affect" Indiana bats.
- May impact individual Blanding's turtles and cerulean warblers but is not likely to cause a trend towards federal listing or a loss of viability.
- May impact individual eastern pipistrelles, bald eagles, red-shouldered hawks, northern goshawks, golden-winged warblers, whip-poor-wills, red-headed woodpeckers, and wood turtles but is not likely to cause a trend towards federal listing or a loss of viability. The alternative would have an overall beneficial effect on these species.
- May impact individual northern wild comfrey plants but is not likely to cause a trend towards federal listing or a loss of viability. The alternative would have an overall beneficial effect on this species.
- Would have a slightly positive impact on habitat for sensitive plant species that prefer open conditions (Missouri rock cress, ternate grape fern, Schweinitz's sedge, Hill's thistle, northern wild comfrey, Engelmann's spike rush, prairie smoke, butternut, small-headed rush, Vasey's rush, furrowed flax, dwarf bulrush, Alleghany plum, pine drops, toothcup, Torrey's bulrush, yellow ladies' tresses, and false pennyroyal).
- Would have a slightly negative impact on habitat for sensitive plant species that prefer more closed canopy conditions (Oneida grape fern, false-violet, Goldie's wood fern, white adder's mouth, Virginia bluebells, American ginseng, bog bluegrass, and Canada yew).

Alternative 3

- Any potential direct and indirect effects on Indiana bats are expected to be insignificant, discountable, or beneficial. Thus, the alternative "May Affect, Not Likely to Adversely Affect" Indiana bats.
- May impact individual Blanding's turtles and cerulean warblers but is not likely to cause a trend towards federal listing or a loss of viability.
- May impact individual eastern pipistrelles, bald eagles, red-shouldered hawks, northern goshawks, golden-winged warblers, whip-poor-wills, red-headed woodpeckers, and wood turtles but is not likely to cause a trend towards federal listing or a loss of viability. The alternative would have an overall beneficial effect on these species.
- May impact individual northern wild comfrey plants but is not likely to cause a trend towards federal listing or a loss of viability. The alternative would have an overall beneficial effect on this species.
- Would have a slightly positive impact on habitat for sensitive plant species that prefer open conditions (Missouri rock cress, ternate grape fern, Schweinitz's sedge, Hill's thistle, northern wild comfrey, Engelmann's spike rush, prairie smoke, butternut, small-headed rush, Vasey's rush, furrowed flax, dwarf bulrush, Alleghany plum, pine drops, toothcup, Torrey's bulrush, yellow ladies' tresses, and false pennyroyal).
- Would have a slightly negative impact on habitat for sensitive plant species that prefer more closed canopy conditions (Oneida grape fern, false-violet, Goldie's wood fern, white adder's mouth, Virginia bluebells, American ginseng, bog bluegrass, and Canada yew).

Alternative 4

- Any potential direct and indirect effects on Indiana bats are expected to be insignificant, discountable, or beneficial. Thus, the alternative "May Affect, Not Likely to Adversely Affect" Indiana bats.
- May impact individual Blanding's turtles and cerulean warblers but is not likely to cause a trend towards federal listing or a loss of viability.
- May impact individual eastern pipistrelles, bald eagles, red-shouldered hawks, northern goshawks, golden-winged warblers, whip-poor-wills, red-headed woodpeckers, and wood turtles but is not likely to cause a trend towards federal listing or a loss of viability. The alternative would have an overall beneficial effect on these species.
- May impact individual northern wild comfrey plants but is not likely to cause a trend towards federal listing or a loss of viability. The alternative would have an overall beneficial effect on this species.
- Would have a slightly positive impact on habitat for sensitive plant species that prefer open conditions (Missouri rock cress, ternate grape fern, Schweinitz's sedge, Hill's thistle, northern wild comfrey, Engelmann's spike rush, prairie smoke, butternut, small-headed rush, Vasey's rush, furrowed flax, dwarf bulrush, Alleghany plum, pine drops, toothcup, Torrey's bulrush, yellow ladies' tresses, and false pennyroyal).
- Would have a slightly negative impact on habitat for sensitive plant species that prefer more closed canopy conditions (Oneida grape fern, false-violet, Goldie's wood fern, white adder's mouth, Virginia bluebells, American ginseng, bog bluegrass, and Canada yew).

MANAGEMENT INDICATOR SPECIES AND WILDLIFE

Existing Condition

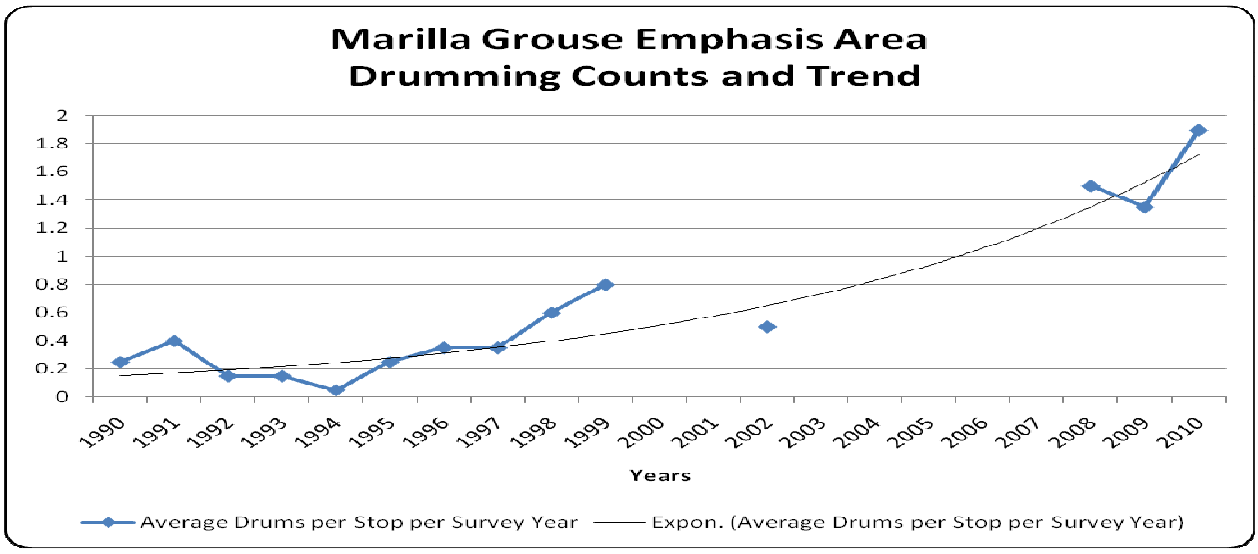
The Marilla Too Project occurs within MA's 2.1, 2.1 G, 4.2, 4.2 G, 4.4, 6.1, and 8.1; of which the majority occurs in MA 4.2 G and 2.1 G. The general Forest Plan direction for enhancing wildlife habitat in these MA's includes: emphasis is given for managing grouse, deer, and wildlife emphasis areas; manage permanent openings and/or grasslands for species viability needs; manage for mesic grasslands;

management activities enhance and increase the variety of wildlife habitats; provide vegetative diversity; and wildlife management is coordinated with adjacent non-NFS land management with emphasis on deer, grouse, and other wildlife management. Some small blocks would be managed to protect isolated, essential areas for endangered, threatened or sensitive species.

The Marilla Grouse Emphasis Area (MA 2.1G and 4.2G) comprises about 7074 acres or about 54% of NFS land in the Project Area. Forest Plan management direction within grouse emphasis areas is to manage aspen intensively to provide quality grouse habitat and to maintain or increase the acres of aspen/birch.

A list of the wildlife Management Indicator Species (MIS) and management direction for these species on the HMNF are found in the Forest Plan (page II 31-34) and FEIS (pages III-179 to III-192). Trends for wildlife MIS on the HMNF are discussed in the 2009 Monitoring and Evaluation Report (HMNF 2010). Wildlife MIS documented in the Project Area included only the ruffed grouse (see Planning Record). Ruffed grouse populations have been monitored in the Marilla Grouse Emphasis Area through drumming counts beginning in 1990. The data indicates that grouse populations have increased over time, with the highest number of drums per stop found in 2010 (Graph 3-1). This data indicates that habitat management in the Marilla Grouse Emphasis Area has had favorable effect on grouse populations.

Graph 3-1



Wildlife surveys were specifically conducted in 2009 for the Marilla Too project within stands proposed for treatment (see Planning Record). Fifty-five species were noted, 48 species of birds and seven species of mammals. Ovenbirds, red-eyed vireos, black-capped chickadees, rose-breasted grosbeaks, and American redstarts were the most abundant bird species. White-tailed deer and eastern chipmunks were the most common mammals noted. No reptiles or amphibians were noted. The common wildlife species noted are generally species associated with maturing to mature deciduous forests. This would be expected, as the stands proposed for treatment in the Project Area are largely maturing/mature forest types. The Project Area is largely within a forested ecosystem and the current NFS land forest types are approximately 75 percent deciduous and 12 percent conifer types (see Table 3-3). Approximately 54% of the forested stands are over 60 years of age. However, there were early successional forest and edge species found in suitable habitats. Upland openings and lowland brush comprise about 3% of the Project Area. The Project Area is largely within LTA 1, 2, and 3, but also has representations of LTAs 4, 5, and 7 (see Table 3-10). This ecological diversity provides for a diverse wildlife resource in the Project Area.

According to the 2009 Monitoring and Evaluation Report (HMNF 2010), the status of most of the vegetation types currently represented on the HMNF is consistent with projections in the Forest Plan. However, there is less early successional habitat than was projected in the Forest Plan. This is due to some

limitations on Forest Service activities, such as budgets. The amount of late successional habitat is increasing proportionally as the forest grows older. These trends influence the diversity and abundance of wildlife on the HMNF.

Species of wildlife commonly hunted or trapped within the Project Area include but are not limited to white-tailed deer, wild turkey, ruffed grouse, American woodcock, fox and gray squirrels, black bear, and coyote. Endangered, threatened, and sensitive species are considered in a separate section of this chapter.

Direct and Indirect Effects

Alternative 1

MIS status in the Project Area and the effects of the activities on the MIS are summarized for each alternative in Table 3-9.

Table 3-9: Comparison of Effects on Management Indicator Species

Management Indicator Species	Principal Habitat Characteristics	Existing Condition in Project Area	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Bald Eagle *(Haliaeetus leucocephalus)*	Super-canopy trees within a mile of large water bodies; secluded settings with abundant rough fish nearby.	Suitable habitat limited within Project Area (PA). Discussed in the Biological Evaluation/Assessment	No change	No change	No change	No change
Kirtland's Warbler *(Dendroica kirtlandii)*	Large blocks of young jack pine, age 6-23 years old, in LTA 1.	Suitable habitat not present within PA. Discussed in Biological Evaluation.	No change	No change	No change	No change
Karner Blue Butterfly *(Lycaeides melissa samuuelis)*	Savanna or barrens habitat with an abundance of wild lupine and other nectar sources.	Suitable habitat not present within PA. Discussed in Biological Evaluation.	No change	No change	No change	No change
Ruffed Grouse *(Bonasa umbellus)*	Aspen and aspen-alder mixes, 5-25 years old provide brood habitat and cover, with older age classes for nesting and winter food sources.	Aspen is a moderate habitat component. Aspen from 0-9 year old currently totals 319 acres. Species present in PA in moderate numbers.	Populations would decline as aspen age class diversity is reduced and begins to convert to other types. In ten years there would be no 0-9 year old aspen within the PA.	Would provide 412 acres of 0-9 year old aspen that would add to or replace the current amount and improve age class diversity. Would assist meeting Forest Plan objectives. Grouse would benefit.	Would provide 267 acres of 0-9 year old aspen that would add to or replace the current amount and improve age class diversity but would benefit grouse less than Alternative 2.	Would provide 360 acres of 0-9 year old aspen that would add to or replace the current amount and improve age class diversity but would benefit grouse less than Alternative 2.
Brook Trout *(Salvelinus fontinalis)*	Cold, well-oxygenated streams.	Brook Trout are not likely found in the PA.	No change	No change	No change	No change
Mottled Sculpin *(Cottus bairdii)*	Cold, well-oxygenated streams.	Mottled sculpin are not likely found in the PA.	No change	No change	No change	No change

There would be no direct effects to wildlife populations under Alternative 1. Implementation of Alternative 1 would generally maintain current forest types and habitat conditions within the Project Area, as there would be no additional vegetation management activities at this time. The current wildlife populations would not likely change in the near future. Analysis using the MIWILDhab2 model indicates that 60 species of breeding and/or migratory vertebrates likely to be found in Manistee County would gain habitat, 81 species would lose habitat, and 256 species would have no gain or loss on NFS lands after ten years from the current condition under Alternative 1 (Thomasma et al. 2007). Populations of wildlife species preferring maturing to mature forest habitats, such as squirrels, scarlet tanagers, and pileated woodpeckers would benefit over time with this alternative, as the forested stands become older and develop mature characteristics. Wildlife populations preferring early successional or opening habitats for parts of their life cycles, such as American woodcock, mourning warbler, and chestnut-sided warbler, would likely decline over time under this alternative. These early successional habitat types are currently about 6 percent of the NFS lands in the Project Area. Without management, it is expected that there would be a further loss in amount or a decline in quality of the aspen and upland opening habitat types over time due to succession.

Road densities in the Project Area are just slightly less than the Forest Plan objective for Roaded Natural MAs and this alternative would not change this density. Road activities would not affect wildlife under this alternative, as no changes would occur. High road densities have negative effects to certain wildlife populations. High road densities within forest ecosystems tend to increase the level of disturbance, rates of poaching, mortality from collisions, and the effects of fragmentation on certain wildlife species (USDA 2001).

In general, failure to control the invasive plants in the Project Area would not directly result in immediate adverse impacts to local populations of wildlife or fish. However, failure to successfully control certain infestations would allow the continued infestation and degradation of more areas of wildlife habitat. Aggressive invasive plants species tend to replace native plants upon which wildlife generally depend for food and cover (Westbrooks 1998). In general, species having relatively specific habitat requirements are more susceptible to adverse effects from the continued spread of invasive plants than would habitat generalists.

This alternative does not assist with meeting the Forest Plan objectives for non-native invasive species control, managing aspen intensively to provide quality grouse habitat, maintain or increase the acres of aspen/birch, creating early successional forest habitat, maintaining upland opening habitat, and maintaining viable populations of certain wildlife species. This alternative does not assist with meeting the Forest Plan objective (page II-33) for ruffed grouse (MIS) habitat and populations of 1000 breeding pairs and 2500 acres of zero to nine year old aspen adjacent to mature aspen.

Alternative 2

Alternative 2 could have direct effects to wildlife through timber harvest, wildlife management activities, tree planting, invasive plant control, etc. The direct effects of this alternative are related to the type of action, timing, duration, and distance of the activities. Approximately 1375 acres would be impacted by vegetative treatments or about 11 percent of the Project Area (see Table 2-1 of the EA). Wildlife species such as breeding birds, bats, small mammals, and less mobile species could be directly affected in these operations due to heavy equipment use (harvesters, skidders, trucks, and bulldozers). Timber harvesting operations or other vegetation treatments that occur during the breeding or maternity season (generally late spring through early fall) have the potential to cause disturbance, destroy or damage nests and dens or kill/injure small young and less mobile species. Larger and more mobile species could travel to escape these activities.

Red pine thinnings that occur during the breeding/maternity season could affect small numbers of animals from this alternative. Wildlife diversity and densities in red pine stands are generally low due to less vegetative diversity within the stands, less mast production, and acidic soils and duff. Because of the small

acreage of red pine thinning (567 acres) and fewer wildlife individuals per acre, the direct effects to wildlife species using these forest types would be minor. Thinning appears to have little or no negative effects to the habitat of Neotropical birds in a largely forested landscape (Barber et al. 2001) and may benefit habitat conditions for species such as the black-throated green warbler. The pine thinning would benefit other species such as the black bear and deer by increasing cover, understory diversity, and forage. Populations of squirrels and pileated woodpeckers, which prefer mature forest communities, would not likely be impacted by the pine thinning treatment, as the majority of the hardwoods in the stands would be retained. Red pine thinning would likely not affect bats because they do not prefer red pine types (Tibbels 2002). Reptile and amphibian habitat would not likely be adversely impacted by the red pine thinning harvest, as it is not a preferred habitat type.

Upland opening habitat improvements would occur on approximately 255 acres of the approximately 350 acres of this habitat in the Project Area. A variety of treatments would be used to improve habitat conditions within these acres; including waterhole construction, brushing or mowing, shrub planting, and prescribed burning. Most of these activities would have minimal direct effects to wildlife as they impact few acres and/or less heavy equipment is used. The upland opening prescribed burning has the possibility of impacting small numbers of individuals, especially small and less mobile types. Prescribed burning in this alternative would occur in early spring before most migratory species would return to the Project Area and before most breeding activities would occur. Prescribed burning has little direct effect on reptiles and amphibians (Renken 2006). The upland opening habitat improvements would have minimal direct effects to wildlife.

Upland opening improvements in 56 stands (255 acres) would assist in maintaining the quality of upland open habitat within the Project Area by maintaining the openings, providing a diversity of foraging habitats, promoting nectar sources from wildflowers and shrubs, and providing other features important to wildlife, such as sunning areas. One hundred forty two acres (40 stands) of the total opening treatments would occur in the Marilla Grouse Emphasis Area. Upland openings are an important habitat component for certain wildlife species. They benefit species such as the ruffed grouse (Larson et al. 2003), American woodcock (Dessecker and McAuley 2001), eastern bluebird (Pinkowski 1991), golden-winged warbler (Rossell et al. 2003), wild turkey (Wunz and Pack 1992), small mammals (Tucker 1992) including bats (Krusic and Neefus 1996), and various insects, such as the monarch butterfly. Prescribed burning is proposed in five openings for a total of 106 acres. This treatment would also benefit wildlife habitat by promoting native grasses and forbs and improving pollinator habitat.

Clearcuts and red pine overstory removal harvests would generally occur from September through March and could directly impact wildlife present in those stands in the fall and winter (generally resident species), but would generally not affect nesting birds and other breeding wildlife. Amphibian populations within these stands would likely decrease within two years of regenerating the stand due to leaf and moisture loss, but populations would likely rebound to normal levels after 20 years (Ash 1997). Reptiles have the potential to be affected by these regeneration projects in small numbers. Snakes may be present within these stands during the winter months and harvest activities could affect some of the hibernacula. White pine underplanting is proposed on 88 acres and would occur in the spring (before May 1) before most migratory birds return and before most bats come out of hibernation. Because of the small area that could be impacted by the regeneration harvests and pine planting, there would not likely be adverse direct impacts to viable populations of wildlife present with the Project Area from these treatments.

Tippy Dam is the only known bat hibernaculum near the Project Area. The dam is on the Manistee River about 0.5 miles away and approximately 18,000 bats winter within the concrete spillway. Timber harvesting, opening brushing, planting, NNIS treatments, and waterhole construction would have no direct effects on the bat hibernaculum because of the distance from the dam. Prescribed burning would only occur when smoke would be transported away from the hibernaculum, therefore there would be no direct effects from burning. Lands within a five mile radius of the dam are considered to be spring and fall swarming habitat for bats. Compartment 404, 410, 411, 413, 415, 416, the east half of 418, and 419 of the Project

Area are within swarming habitat known as the Tippy Management Zone (TMZ). Activities in this alternative that could impact swarming bats would have seasonal restrictions to provide protection (see Unit Cards). This alternative would benefit bat habitat within the TMZ. Creating age class diversity within the forested areas of the TMZ, maintaining existing openings, and creating water sources provide the habitat needs for a variety of bat species (Krusic et al. 1996, Perry and Thill 2007, O'Keefe et al. 2009). Maintaining the aspen type through management in the TMZ may also benefit certain species of bats because they consistently roost in aspen (Vonhof 1996, Kurta 2000). Of fourteen northern bat roosts found on the MNF in 1998-1999, 50% were found in aspen.

Snag and den tree components and dominant mast producing trees would be retained in all harvest units. Snags or wildlife trees would be created in the mature red pine stands, overstory removals, upland opening edges proposed for vegetative treatments if needed. Reserve trees or groups of reserve trees would be retained in all regeneration units. Within the Marilla Grouse Emphasis Area, reserve trees would be left in clumps to reduce the overstory effect in small harvest units. A scattered residual overstory of 10-15 square feet basal area could reduce stem densities of aspen and/or reduce sucker growth (Perala 1977). These activities would maintain and provide roosting and foraging habitat, mast production, future den and snag trees, habitat, bird diversity, and stand diversity within the proposed stands. Retaining woody debris in the harvest units would provide down woody material for small mammal cover, reptile and amphibian habitat, and prey habitat that benefits predators such as the marten and woodland raptors.

The major vegetation changes that would occur with Alternative 2 are the aspen clearcuts (412 acres), and red pine overstory removals (40 acres). These treatments would indirectly benefit wildlife diversity by providing early successional habitats in the Project Area. The Project Area has about 3392 acres of aspen of manageable aspen (about 54 acres in old growth). Management of the aspen type available for harvest is important to maintain wildlife diversity and populations in the Project Area. The aspen forest type is important for not only the ruffed grouse (Dessecker and McAuley 2001) but also the American woodcock and the golden-winged warblers, which are experiencing range-wide population declines (Roth 2001, Roth and Lutz 2004, Cooper et al. 2008). Some species of bats use clearcut areas for foraging and it may improve seasonal availability of insect prey for bats (Erickson and West 1996). Early successional habitats are important as post-fledgling, molting, and migration habitat for some species of birds that typically use mature forests for breeding (Anders et al. 1998, Vega Rivera et al. 1999, Suthers et al. 2000, Vega Rivera et al. 2003). Some species of turtles prefer edges of early successional areas for foraging habitat (Compton et al. 2002). Early successional habitats are also important for prey species for many carnivores (Litvaitis 2001). Regeneration harvests can affect movement patterns of some wildlife species for short periods of time (usually until the canopy redevelops). However, these small regeneration units scattered over a Project Area of over 13,000 acres (NFS acres), would not disrupt movement patterns in general nor would it isolate any wildlife populations.

Within the Marilla Grouse Emphasis Area, 374 acres of aspen would be clearcut in 26 stands. The average size of these harvest units would be 14 acres. Small clearcut units interspersed within other age classes of aspen provide for optimum grouse habitat. Ruffed grouse use regenerating aspen for brood habitat and sapling/pole stands for breeding (drumming) and winter cover. Mature stands are used for nesting and winter food sources.

This alternative would decrease the amount of mature forest habitat throughout Project Area. This would not likely decrease the overall numbers of mature forest habitat dependent species such as pileated woodpecker and squirrels. Approximately 1,150 acres of NFS land in the Project Area is included in the Forest's old growth design. This alternative proposes no treatments in old growth stands. The regeneration harvests proposed in this project could increase the amount of edge. This may reduce avian nesting success due to the effects of forest fragmentation (higher rates of predation, higher rates of parasitism, and reductions in pairing success) (Faaborg et al. 1995). However, recent studies have shown that the impacts from fragmentation created by logging are less than those created by permanent edges, such as agriculture and development (Suarez et al. 1997) especially in largely forested landscapes (Barber et al. 2001). Some

species of birds, such as ovenbirds, may react to edge effects by laying more eggs and having higher nesting densities, thus offsetting the negative effects. Edges from forestry practices such as clearcutting produce only temporary edges and fragmentation. Aspen regenerates quickly and within approximately 5-10 years, the stands would have closed canopies, and in about 20+ years, tree heights approach the original stands. The rates of nest parasitism from brown-headed cowbirds would not likely increase from this project as they are primarily dependent on the amount of agricultural lands in the Project Area (Moris and Thompson 1998). Any adverse effects from regeneration harvests from the proposed project would likely be short-term for species favoring forest interior conditions. The following photos show an example of a mature aspen stand proposed for clearcut treatment and age classes after harvest.

Photo 3-1
Mature Aspen Stand

Photo 3-2
Aspen Clearcut 1Year After Harvest

Photo 3-3
Aspen Stand Showing 3 Age Classes After Harvest

Road densities in the Project Area are slightly less than the Forest Plan objective for Roaded Natural MAs and none of the alternatives would change this density. Under Alternatives 2, 3, and 4, road management within the Project Area, including road construction, reconstruction, and temporary road construction would directly affect small numbers of small, less mobile animals. Road closures would benefit wildlife in general by decreasing the amount of disturbance and reducing the effects of fragmentation.

Invasive plants that replace native vegetation result in a loss of native plant food and habitat sources for wildlife, and result in a loss of species richness and biodiversity. In this case, since autumn olive and honeysuckle are known wildlife food species, direct and indirect effects would be the removal of habitat and food for certain wildlife species. NNIP treatments under this alternative would affect approximately 8.9 acres. Since stem or stump application of the herbicide would occur for eight NNIP species (Table 3-8),

limited amounts to no pesticides would be present in portions of plants that would be consumed by wildlife. Sponge or limited range hand spraying would minimize herbicide contact with other species. Where non-native invasive fruit-bearing shrubs are removed (autumn olive, honeysuckle), alternate native fruit-bearing shrubs, such as hawthorn, dogwood, blackberry, raspberry, and serviceberry, would be replaced. Although autumn olive and honeysuckle serve as a nectar sources for bees and other insects, the native shrubs that would be planted in its place would also provide a nectar source. The proposed physical weed treatment poses a relatively low potential for disturbing wildlife. Digging up or cutting down NNIP shrubs might disturb bird nests or animal burrows. It is possible that some less mobile wildlife could be physically injured or killed from people or equipment during weed treatments. Activities would be performed carefully to avoid physical injury to less mobile wildlife, or to nests or burrows. If work is conducted in areas containing nests or burrows of rare or sensitive wildlife, those locations would be flagged or marked.

Ecological risk assessments conducted for glyphosate suggest that use at rates commonly used by the Forest Service pose little or no risk to wildlife (USDA 2003). The proposed herbicides are not cholinesterase inhibitors such as organophosphate or a carbamate insecticide (or chemically related to such insecticides) that are highly toxic to wildlife, especially insects and other invertebrates. Nor are the proposed herbicides chemically related to the chlorinated hydrocarbon insecticides such as DDT that are highly persistent in the environment and known for causing eggshell thinning of raptors (birds of prey) such as bald eagles and ospreys. Herbicide toxicity and risk data for mammalian and terrestrial wildlife species suggest glyphosate is generally safe to mammals if used in accordance with the manufacturer's label. In addition, glyphosate is not expected to bioaccumulate in the food chain (USDA 2003). The small area (<9 acres) proposed for treatment in this alternative and the type of treatment (stump application) drastically reduces or eliminates any exposure of wildlife to the herbicide.

The potential toxicological effects of herbicides on amphibians are not well understood. Substantial declines in the populations of several amphibian species have been documented (DAPTF 2003). One of the suspected causes of the widespread amphibian population declines is increased use of pesticides, including but not limited to herbicides (Bury *et al*. 2004). Other suspected causes of amphibian decline include physical disturbance of wetlands; impacts to wetlands and other habitats from timber harvest and forest management, introduction of non-native predators, acid precipitation, increased ultraviolet radiation, and diseases resulting from decreased immune system function (Bury et al. 2004). Herbicides would be applied carefully following the manufacturer label instructions, thereby minimizing the potential for inadvertent exposure to wildlife, including amphibians (see Mitigation Measures in Chapter 2). None of the control activities proposed as part of Alternative 2 would contribute to the loss or degradation of wetlands or other amphibian habitats or to other activities suspected of contributing to amphibian decline.

There are no expected impacts to any wetland, riparian, or aquatic species from this project due to the distance from the vegetation treatment units. Because there are no activities proposed in these habitats, important amphibian and reptile habitats would be protected (Dupuis et al. 1995).

Analysis using the MIWILDhab2 model indicates that 121 breeding and/or migratory vertebrates likely to be found in Manistee County would gain habitat, 46 species would lose habitat, and 89 species would have no gain or loss on NFS land after ten years from the current condition under Alternative 2 (Thomasma et al. 2007). There would be no loss of viability for any species found in the Project Area. Alternative 2 would have greater benefits to overall wildlife populations and habitat than Alternative 1 and would assist in meeting Forest Plan objectives. This alternative assists with meeting the Forest Plan objective (page II-33) for ruffed grouse (MIS) habitat and populations of 1000 breeding pairs, 2500 acres of zero to nine year old aspen adjacent to mature aspen, and providing amounts of habitat dispersed across the HMNF.

Alternative 3

The direct and indirect effects of Alternative 3 are similar to Alternative 2. The major difference is that this alternative has 145 fewer acres of aspen regeneration, 40 fewer acres of overstory removal, no white pine

underplanting, and less snag creation and NNIP treatments. This would reduce the direct impacts to wildlife populations but would also reduce the beneficial impacts to wildlife habitat. Analysis using the MIWILDhab2 model indicates that 96 breeding and/or migratory vertebrates likely to be found in Manistee County would gain habitat, 39 species would lose habitat, and 121 species would have no gain or loss on NFS land after ten years from the current condition under Alternative 3 (Thomasma et al. 2007). Alternative 3 would have greater benefits to overall wildlife populations and habitat than Alternative 1 and would assist in meeting Forest Plan direction, but would be less beneficial to wildlife than Alternative 2.

Under Alternative 3 no opening prescribed burning would occur; however, these opening would be maintained by mowing or brushing. Although the proposed mowing and brushing would maintain the existing openings, they are not as effective as prescribed burning in stimulating the growth of native vegetative species and promoting pollinator habitat. The mowing and brushing treatments generally occur during the summer season when plants are flowering; and therefore, reduce the amount of potential pollinators. Prescribed burning generally occurs early in the season before plants are flowering; therefore, potential pollinators are not as severely impacted.

Alternative 4

The direct and indirect effects of Alternative 4 are similar to Alternative 2. The major difference is that this alternative has 52 fewer acres of aspen regeneration, 41 fewer acres of white pine underplanting, and no red pine overstory removal. This would reduce the direct impacts to wildlife populations but would also reduce the beneficial impacts to wildlife habitat. Analysis using the MIWILDhab2 model indicates that 125 breeding and/or migratory vertebrates likely to be found in Manistee County would gain habitat, 38 species would lose habitat, and 93 species would have no gain or loss on NFS land after ten years from the current condition under Alternative 3 (Thomasma et al. 2007). Alternative 4 would have greater benefits to overall wildlife populations and habitat than Alternative 1 and 3 and would assist in meeting Forest Plan direction, but would be less beneficial to wildlife than Alternative 2.

Cumulative Effects

The cumulative effects analysis area for wildlife resources encompasses the Project Area and all lands within the immediate compartments adjacent to the Project Area boundary (a buffer of about one to two miles). The buffer around the Project Area would include the majority of the habitat utilized in the home ranges of wildlife species found within or immediately adjacent to the Project Area. Fragmentation effects (if present) from the activities proposed generally would not exceed a two mile distance from the Project Area. Dispersal of most wildlife species from or into the Project Area would likely be contained within the cumulative effects analysis area. This cumulative effects analysis area including an additional 10,633 acres of NFS lands in the adjacent compartments and about 8,889 acres of additional private lands. Management of NFS lands adjacent to the Project Area but within the cumulative effects area has been similar to that in the Project Area. Private lands generally include forest lands, agricultural lands, and residential areas. The timeframes for the cumulative effects analysis are generally from 2000 through 2020.

In general, wildlife populations on the HMNF have recovered since the early 1900s. The exceptions to this statement are the total extinction of the passenger pigeon, the eastern elk, and the continued absence of species such as the fisher and the gray wolf. The wild turkey was successfully reintroduced into Michigan in the mid-1900s and is now considered a game species on the HMNF. The American marten and the trumpeter swan, also once extirpated on the HMNF, have been recently reintroduced and are currently present in small numbers.

The overall forest ecosystem on the HMNF is predominately favorable to wildlife species requiring maturing to mature forest types, as is the Project Area (HMNF 2001). Reforestation efforts in the 1930s by the HMNF have influenced the wildlife habitat in the Project Area by providing maturing conifer habitat that was previously logged at the turn of the century. This habitat restoration has been beneficial to wildlife

species such as the marten. Without current or future forest management through timber harvests, wildlife habitat improvement, fire protection, or major natural disturbances, the Project Area would provide increasing amounts of mature and over mature forest habitat and improve habitat conditions for later successional species, such as the pileated woodpecker and marten. Early successional habitats and species would decline. Reduced forest harvesting in the past 10-15 years in the United States has lowered the representation of early-successional stages in some forest types to below-historical levels (The Wildlife Society 2005). Particularly in southern and eastern forests, the shift has reduced the availability and condition of habitats for early-successional wildlife such as woodcock, ruffed grouse, and prairie warblers. In these situations, a well-balanced program of vegetation-management activities is required to maintain the mix of successional stages and vegetation conditions that provides for the full diversity of habitats and species.

Factors such as wildlife management, forest management, fire suppression, ecological succession, agriculture, and development have influenced wildlife populations within the cumulative effects area and continue to do so. In general, the overall forest ecosystem within the cumulative effects area favors wildlife species preferring maturing forest types. Aspen regeneration, pine thinning, overstory removal, shelterwood treatments, snag creation, tree planting and release, NNIP treatments, and upland opening improvements have occurred on NFS lands within the cumulative effects area since 2000 (see Tables 3-6 and 3-7). These activities have improved wildlife habitats and habitat diversity. Based upon the direction in the Forest Plan, vegetation management would continue to occur within the cumulative effects area in the foreseeable future. Future management in the cumulative effects area would likely include additional NNIP treatments, red pine, aspen, hardwood, and upland opening treatments.

The vegetative treatments proposed in this project along with future management direction from the Forest Plan would meet or move the Project Area towards Forest Plan objectives (desired future condition) and provide for stable or improved habitat conditions for most of the wildlife species currently found within the cumulative effects area.

There are no major expected changes in land uses on non-federal lands within the cumulative effects area. Minor increases in development on private lands are expected in the future. This would slowly increase the amount of residences in the area, slowly decrease the amount of undeveloped wildlife habitat, and increase wildlife populations associated with human development such as starlings and raccoons. Agriculture and old-field habitats are present on private lands. These areas may cause fragmentation effects such as increased predation and parasitism to Neotropical migratory birds in the cumulative effects area. They also provide habitat for grassland birds that are not generally found on the HMNF. Wildlife habitats may be changed on non-federal lands through future forest product harvests within the cumulative effects area. The amount and types of timber harvests on private lands within the cumulative effects area are likely to remain similar to current harvests in the foreseeable future.

White-Nose Syndrome (WNS) is a new condition recently found in bats in the northeastern United States. Affected bats may have a white fungus on their noses and occasionally other hairless parts of their bodies including arms, wings, and ears. The exact cause of WNS is still being investigated, but has been associated with high mortality rates at some sites. WNS was first identified in 2006 and has since been confirmed in hibernating bats in New York, Vermont, Connecticut, Vermont, New Jersey, Pennsylvania, West Virginia, Virginia, and Massachusetts.

White-Nose Syndrome has been detected in Indiana bats, little brown bats, northern long eared bats, small-footed myotis and eastern pipistrelles. The Northeast Region of the US Fish and Wildlife Service (USFWS) is maintaining a web site on WNS with some of the most recent scientific information on this syndrome (http://www.fws.gov/northeast/white_nose.html). The USFWS is working in close cooperation with the States and many university and research laboratories to identify the cause and possible mechanisms in which WNS may be spread. The HMNF will follow the lead of the USFWS and take appropriate action as needed.

Bat species that may forage or roost in or near the Project Area that have been affected by WNS in other states include the little brown bat and northern long eared bat.

The vast majority of bats with WNS have been found during the winter in caves where the bats hibernate. No bat hibernacula are known to exist on NFS lands within the HMNF as there are no caves or mines, although there is a known hibernaculum at Tippy Dam (Wellston, MI) in the overflow structure. Recent surveys of this hibernaculum in 2008 found no evidence of WNS (Kurta, personal communication). To date no confirmed cases of WNS have been found on or near the HMNF or anywhere else in Michigan. At this time, the only recommendations developed by the USFWS and their partners are aimed at preventing the spread of WNS. Efforts focus on human visitation or research in affected hibernacula, human visitation between affected and unaffected caves and mines, and human handling of affected bats (see above FWS website for details). Bat swarming surveys at Tippy Dam have been suspended due to the WNS precautions (Kurta, personal communication).

There would not be cumulative effects from timber harvest and WNS because WNS is not currently known to occur in Michigan. Forest Plan guidelines that reserve suitable roost trees would minimize potential loss of roost habitat for tree-roosting species. Harvest activities and management actions have and would continue to provide suitable habitat for bats.

Currently, it is difficult to predict what the potential threats might be to bat populations on the HMNF and impossible to take action to limit the spread of this disease except at hibernacula. The HMNF is in close contact with the USFWS to stay informed about this issue and take appropriate actions as needed regarding WNS.

SOILS, AIR, AND WATER QUALITY

SOILS

Existing Condition

Landtype Associations and Ecological Land Type Phases

Landtype Associations (LTAs) are contiguous areas of land that have similar glacial landforms, overstory plant communities, and soil associations. LTAs correspond with different depositional and erosional landforms resulting from the most recent glacial period. Glacial deposits in northern lower Michigan consist primarily of sand, silt, clay and gravel, with silt and clay layers associated with areas of slow-moving or ponded waters, and sand and gravel layers associated with more rapidly moving waters. Land acquisition resulted in the more productive silt and clay landforms retained and developed, principally for agricultural uses, by private landowners, and less productive sandy landforms becoming National Forest System lands.

There are eight LTAs present on the Huron-Manistee National Forests; six of these occur, but only three are predominant, within the Project Area. LTAs have consistent general trends in soil parent material and vegetation, but differences in productivity, water table depth, slope, drainage, soil texture, and wildfire frequency and intensity affect potential natural vegetation. These influences are characterized and mapped as Ecological Land Type Phases (ELTPs), and serve as the basic units of ecological land management (Cleland et. al, 1993). ELTP descriptions represent a summary of information about a specific site relative to the landform, soils, ground flora, and potential natural vegetation. The ELTPs for the sites proposed for treatment in the Project Area are listed in the Treatment Unit Cards (located in Appendix A). Table 3-10 Ecological Characteristics for NFS lands displays the LTAs and ELTPs mapped within the Project Area, and their relationship to soil names (NRCS 2010).

Table 3-10: Ecological Characteristics for National Forest System Lands

LTA	Method of Formation	Topography	Ecological Species Groups		ELTPs	Acres of ELTP	Representative Soil Names
1 Outwash Plains	Deposited by water melting from glaciers.	Level, but may be pitted or dissected.	Overstory: Black oak, white oak, white pine, red pine.	Understory: Blueberry	220	2,010	Plainfield
					222	268	Plainfield
					224	47	Covert
2 Ice-Contact Hills	Formed in coarse to medium-textured sandy and gravelly material.	Hilly, with gently rolling to moderately steep slopes.	Overstory: Black oak, red maple, white oak, white pine, red pine.	Understory: Starflower.	221 223 225	1,109	Coloma
3 Sandy Morainal Hardwood Hills	Formed in sandy, gravelly, and loamy material overlying deposits ranging from sandy loam to clay.	Hilly, ranging from gently rolling to steep.	Overstory: White pine, beech, red oak, and red maple.	Understory: Maple-leaf viburnum, naked-leaved tick-trefoil, sweet cicely	230	1,116	Grattan
					231 233	2,455	Mollineaux
					235 237	1,875	Spinks Fogg
					240 242 245	59	Kaleva
4 Wet Sand Plains and Lake Plains	Formed in coarse and medium textured sandy materials.	Level, with low ridges in some areas.	Overstory: Red maple, red oak, white birch.	Understory: Bunchberry, leather-leaf, blueberry.	262 264	34	Saugatuck Jebavy Pipestone
					272 273 274	75	Granby Kingsville Glendora
5 Alluvial, Fluvial, and Organic	Develop or accumulate along streams or in depressions.	Nearly level.	Overstory: White cedar, tamarack, black spruce, hemlock, red maple.	Understory: Labrador tea, Canada violet.	280 281 282 Open water	272	Napoleon Houghton Carlisle Kerston Adrian
7 Loamy Outwash and Ground Moraines	Unsorted, non-stratified clay to boulder size materials deposited by rapidly melting ice.	Level to gently rolling.	Overstory: Sugar maple, beech, basswood, red oak, white ash.	Understory: Bloodroot, blue cohosh, bellwort.	246	22	Kaleva

Soil Productivity

Soil productivity naturally varies by ELTP, and is affected by past uses which caused loss of soil organic matter, increased soil bulk density (compaction) and accelerated erosion. Soil productivity is maintained and improved by:

- retaining or replenishing organic matter and its associated nutrient and water holding capacity.
- maintaining soil bulk density so that water infiltration rates and plant growth are not impeded.
- limiting soil erosion to naturally occurring rates.
- preventing contamination with organic chemicals (Brady and Weil 2002).

Soil productivity has been influenced by local topography, proximity to open water, depth to the water table, the amount and type of vegetation cover, and how that cover has been established or maintained. Many forests, located on well drained and level topography, have been impacted by timber management or other agricultural practices more than one time; in other locations, physiographic limitations resulted in less

intensive management. The characteristics of the various ELTPs and their capacity to sustain productivity associated across a range of activities have been published in the Soil Survey of Benzie and Manistee Counties (USDA-NRCS/FS, 2008).

National Forest Land Suitability

The NFS lands within the Project Area are generally classified as forest land, suited for timber production, or suitable for timber production but proposed for other emphasis. Each stand has a land suitability code (LSC) which indicates these classifications. Forested lands suitable for timber management (LSC 500) are planned for long-term timber production, including regenerating to forest in the future. Stands with a LSC of 600 are forested lands that are suitable for timber production, but are proposed for Other Emphasis that preclude regulated timber production in order to achieve other multiple-use objectives. Non-forest land (less than 10% tree cover or developed for non-forest use, e.g., permanent road > 120' in width) has a LSC of 200, and also includes areas of large permanent streams or open water. Lands classified as LSC 700 are physically unsuitable for timber harvest (protect soil and watershed), and LSC 800 are lands identified for minimum level management (isolated NFS land). Lands in LSC 600 include Other Emphasis (for restoring Old Growth).

Under all alternatives, the LSC for three stands would be changed to depict a more accurate and current characterization of the stands. The LSC changes are as follows and are also described in Appendix A: Compartment 410, Stand 35 has a LSC of 500 (forested); however, the southeast portion of this stand is an upland opening. The LSC for the opening portion of this stand would be changed to 200 (non-forested). Compartment 410 Stand 53 has a LSC of 500; however, this stand is a frost pocket opening. The LSC for this stand would be changed to 200. Compartment 411, Stand 4 currently has a LSC code of 200. This opening is becoming forested. The LSC for this stand would be changed to 500.

Direct and Indirect Effects of All Alternatives

Soil Productivity: Organic Matter

Soil organic matter is affected by when and how forest vegetation is treated (including wood removal, prescribed fire, skid trail, landing and road construction and reconstruction), the type and amount of vegetation that is re-established after a treatment, wildlife and plant habitat improvement activities in non-forested areas (including prescribed fire, disking, seeding and herbicide application), equipment operations and season of harvest, and erosion from wind and water. Maintenance of soil organic matter is vital to sustaining soil productivity because it is the principal source of nutrients for vegetation and also affects soil fauna and organisms.

Under Alternative 1, no impacts on soil organic matter from proposed *aspen clearcuts, thinning, forest type conversions, and planting* would occur. This alternative would result in the highest above and below-ground biomass levels (Pritchett and Fisher, 1987). As dead trees and litter fall decay, carbon is released to the atmosphere as CO^2, or becomes part of the above and below ground biomass, litter, dead wood, and soil carbon pools. Increasing soil organic matter would be accompanied by an increase in the relative abundance of soil nutrients, microorganisms, and fungi. There would be a net increase in soil carbon and other nutrient levels as organic matter accumulates within the upper soil profile, undergoes decomposition, and becomes incorporated in the soil profile. This would be the result of natural forest maturation and re-growth, as commercial treatments that would export wood or reduce litter and biomass would not occur. The result of these natural processes is that young forests accumulate soil organic matter at a greater rate than do mature forests, while mature forests maintain relatively higher soil organic matter levels than young forests (Brady and Weil, 2002). Therefore, as the forested areas continue to grow and mature, soil productivity would gradually increase and recover from previous impacts.

Under Alternative 2, the effects on the Project Area's soil organic matter would be local in scale and minor in extent. Stone (1999, 2000) has documented loss of site productivity effects for similar harvest sites on

the Huron National Forest when the forest floor is removed. Nave (unpublished, 2009) looked at harvest effects on soil carbon storage in temperate forests and found that for Spodosols (ELTPs 220 – 245), carbon stored in the organic horizon declined more than carbon stored in the mineral horizons, and that a period of 50 – 70 years may be required to recover to pre-harvest levels; this effect was more pronounced in hardwood than in conifer forest cover types. Retaining on site the majority of woody material <4" in diameter from harvested trees in areas proposed for clear cutting and overstory removal (and a lesser amount of this material in pine thinning units) would reduce this adverse effect on soil productivity. This retention would help maintain above- and below-ground organic matter and provide a substrate for fungi, bacteria, and other micro-organisms in the soil. Harvesting during periods of non-saturated soil conditions and plant dormancy would sustain site productivity by conserving organic matter in litter and root storage in hardwood species (Hallett and Hornbeck 2000). Nutrient cycling processes and organic matter decomposers would mitigate the presence of retained conifer woody material as a hazardous fuel within 5 years of the harvest. Individual timbered stands would experience an immediate export of site nutrients through the removal of tree stem wood. Nutrients being stored and utilized by the trees at the time of harvest would be lost from the system. In clearcut and overstory removal harvests, this loss would be greater than in the thinnings. The loss of nutrients would be lessened by the source/sink processes of the existing vegetation, where forest vegetation regrowth at these sites would occur rapidly, restoring the ability of the harvested area to retain, amass, and cycle nutrients via leaf litter and root growth. In addition, Lederle and Mroz (1991) determined that bracken fern contributes to nutrient retention and cycling, especially if the harvests occur prior to frond maturation, i.e., mid to late summer. Tree regeneration would be expected to occur the first year after harvest by either aspen suckering or regrowth of existing seedlings. This, coupled with the extensive root systems left from the previous forest trees, would reduce the susceptibility of each site to short-term nutrient loss from leaching and the erosive properties of wind and water. In thinning harvests, fewer nutrients would be exported from the ecosystem, while remaining trees would continue to retain, amass, and cycle nutrients, including the additive processes accruing from understory vegetation growth and regrowth. Skid trails, landings, and low standard roads are expected to occupy a small percentage of the area, and organic matter removal or relocation attributable to these impacts would not cause a significant loss of inherent soil productivity.

White pine seedling planting would modestly increase soil productivity as the seedlings grow, mature, and become soil organic components; associated affects from restoring and maintaining soil humus from conifer residue would further diversify the moder type humic substances that are resistant to oxidation and important for retaining nitrogen against rapid mineralization (Brady and Weil 2002).

Under Alternatives 3 and 4, the direct and indirect effects on soil organic matter would be similar to that of Alternative 2 for the portions of the Project Area proposed for aspen clearcutting and red pine thinning treatments. The reduction in aspen regeneration harvests and the elimination of the red pine/hardwood conversion harvests would mean that approximately 40% fewer acres would experience the impacts related to commercial harvesting practices. Soil organic matter in these mature and maturing forested stands would show a gradual increase in soil organic matter levels as individual trees grow, die, and cycle nutrients. In these areas, there would be an accompanying reduction in organic matter displacement associated with skid trails, haul roads, and landing sites.

The existing humic layer and substances would not be influenced or diversified by establishing a white pine component in a young oak forest that formerly had white pine as an associate species.

Appendix A, Treatment Units, contains mitigation measures to reduce the adverse effects on soil organic matter levels from forest vegetation harvest and equipment use.

Upland Opening Maintenance and Improvement: Under Alternatives 2, 3 and 4, the forest and shrub canopy in these areas would be reduced by using mechanical treatments (mowing or brushing) to between 5-15% of full canopy. Mechanical treatments to reduce canopy cover would raise growing season soil temperatures by increasing direct solar radiation reaching the soil surface, and begin to change the dynamics

of biomass accumulation. Greater soil temperatures would stimulate organic matter decomposition and decrease the thickness of the O horizon; proportionately more organic carbon would accumulate in the A and B soil horizons as the herbaceous root mass increases. This change would promote short-term nutrient mineralization that would be lost through leaching if prompt revegetation does not occur (Brady and Weil 2002).

The prescribed burns proposed in the upland openings in Alternative 2 and 4 would be of short duration and low intensity. The combination of low fire intensity and short duration would decrease short-term porosity of the mineral soil where runoff catches ash and other fine debris in existing depressions (Ibid). Prescribed fire activities of this intensity generally increase the availability of Ca, Mg, and K via combustion of soil organic matter; N, and P are modestly decreased from volatilization, but the majority of soil organic component of these nutrients are converted to forms that are either readily available to plants or soon lost through leaching, although in acid soils, P chemically binds to Al, Fe, and Mn oxides (Certini 2005). Prompt re-vegetation on areas exposed to prescribed fire would minimize the leaching of N (Pritchett and Fisher, 1987). If nitrogen-fixing species are included in the re-growth, burning activities may restore the original nitrogen pool in the soil (Certini 2005). This change in nutrient status and chemical status would be of short duration (1-3 years) as the nutrients are used by the existing vegetation, adhere to soil particles, are leached through the soil profile, or lost to transport (wind and water). Prompt re-vegetation with permanent woody and/or herbaceous vegetation would restore physical properties (temperature, infiltration) and nutrient leaching (calcium, magnesium, potassium) similar to that of pre-fire conditions (Pritchett and Fisher 1987). Natural recovery of microorganisms (invertebrates, fungi, bacteria) would occur over a period of one to three years. Soil carbon levels and profiles would be affected by the type of vegetation dominating after the fire: where woody species dominate, carbon balances are restored to pre-fire conditions as the trees mature. In contrast, where herbaceous species are dominant, both the amount and location of soil carbon are changed (Miller and Donahue 1990). Total nitrogen losses, incurred by volatilization and leaching, are compensated by increased mineral forms (available to plants) of nitrogen due to increased mineralization rates (Pritchett and Fisher 1987) and atmospheric inputs (Boerner and Brinkman 2003).

The range of the effects on soil organic matter from mechanical and prescribed fire treatments would be smaller in Alternative 3 because fewer acres are subject to prescribed fire treatments than in Alternatives 2 and 4.

Transportation System and Recreation Uses: Under Alternative 1, no Forest Road closures or improvements would be made. Forest roads that are currently open would remain open, non-vegetated, continue to erode and deposit sand in road depressions, and are precluded as a source of additional organic matter. Based on past experiences in the Project Area, the current road system is not likely to increase, as Forest road closure efforts are generally sufficient to deter new user-developed roads. The most likely impact is road widening, i.e., “go-arounds”, that are developed or widened on rough or seasonally puddled Forest and County road segments. Open roads would remain void of vegetation, and unable to be a source of soil organic matter.

Vehicle use at dispersed locations along Forest and County roads would continue to retard, reduce, or eliminate permanent vegetation cover; soil compaction and displacement also occur in these locations. The most heavily used dispersed areas would frequently be expanded, with new locations readily established by users that suit their immediate needs; these effects would be most pronounced along Open County and Forest roads. OHV damage is more likely in hilly terrain and sites of OHV damage would continue to degrade and would likely expand, further displacing top soil and damaging vegetation in surrounding areas. Trash dumping would directly impair soil productivity by introducing pollutants, NNIS, or smothering small vegetation.

Under Alternatives 2, 3 and 4, a new Forest System road (about 0.2 miles long) would be constructed. One Forest System road (FR 8044) about 0.4 miles in length is currently showing open on HMNF’s Motor Vehicle Use Map; however, it has been closed years ago with an earthen berm. The MVUM would be changed to correct the status of this road. Portions of Forest System and County roads would be

reconstructed made to improve access to treatment units, improve user safety, or to reduce accelerated erosion and compaction on permanent roads, and numerous short-term use roads and landings would be developed. Soil organic material is displaced or removed when roads are improved or constructed; the affected topsoil remains in close proximity or is returned to its previous location, and contributes to organic matter replenishment in adjacent soil profiles. In addition, roads and landings occupy a very small amount of the Project Area; therefore, these effects are local in scale and minor in extent.

Soil Productivity: Compaction

The susceptibility of a soil to compaction depends on the amount of organic matter in the soil, the overall texture of the soil, and soil moisture content. In general, the greater the organic matter and clay content in a soil, and the drier the soil is when a mechanical treatment occurs, the more resistant to compaction the soil is (Greacen and Sands 1980). Acceptable soil compaction amounts away from skid trails and landings are expressed by faint wheel tracks or slight depressions. Soil compaction in the top 0-4 inches is slightly greater than observed under natural conditions, and the change in soil structure from granular to massive or platy is restricted to the surface soil and is non-continuous. Acceptable soil compaction amounts along skid trails and within landings are expressed by evident wheel tracks or moderate depressions. Soil compaction in the top 0-12 inches is moderately greater than observed under natural conditions, and the change in soil structure from granular to massive or platy is restricted to the surface soil and is generally continuous; large roots may penetrate the platy structure, but fine and medium roots may not (Soil Disturbance Field Guide 2009).

Aspen clearcuts, thinning, forest type conversions, and planting: Under Alternative 1, no new management activities would occur. The effects of prior soil compaction, in areas having permanent vegetation, would continue to decrease as soil organic matter accumulates and soil microorganisms reduce the bulk density of affected areas and restore water infiltration rates (Brady and Weil 2005). Recovery from compaction would occur over a period of many years, but have fewer adverse effects in sandy soils than in other soil textures (Stone, 1999 and 2000). Soil compaction on and around permanent roadbeds may require 40 years for full recovery of infiltration rates (Greacen and Sands 1980).

Under Alternative 2, compaction would occur on collector skid trails (more passes than are typically associated with only tree felling and loading) and landing sites, but would not be detrimental to soil productivity if the increase in soil bulk density < 15%, if the decrease in porosity < 10%, and if macropore space is reduced < 50% (USDA-Forest Service, FSM 2509.18). Harvesting during periods of non-saturated soil conditions would minimize compaction of soil macropores and micropores, maintaining aeration and drainage and plant root growth potential (Brady and Weil 2002). As the root systems of felled trees decay, water infiltration would increase from channeling effects, and would provide increased nutrient and microorganism mobility in these areas, and work to slowly reverse the effects of compaction from harvesting activities. In general, thinning activities would result in skid trails receiving higher volumes of harvesting equipment traffic over a single area, compared with clearcut areas where skidding would be dispersed. The length of time for a compacted soil to be restored to its original bulk density depends on the soil texture and degree of compaction; sandy soils and compacted zones > 6 – 10" below the surface may require 5 – 18 years. Page et.al (2006) found that on sandy soils in lower Michigan, soil bulk density on moderately compacted sites varied by depth one year after treatment, and increased between +9 - +24%; after five years, the range was +8 - +17%. Powers et.al (2005) found that after 10 years, soils rarely recovered from severe compaction, regardless of their initial bulk densities.

Due to the reduction in harvesting activities, less area would be affected by compaction related to equipment passes under Alternatives 3 and 4 than with Alternative 2. As both Alternatives present similar acreages for these treatments, there would only be a slight difference between Alternatives 3 and 4 relative to overall compaction effects. The adverse effects of compaction would be not impair soil productivity if each treatment area does not experience more than a 15% increase in bulk density, a decrease in porosity < 10%,

and if macropore space is reduced < 50% (FSH 2509.18). Appendix A, Treatment Units, contains mitigation measures to reduce the adverse effects of compaction from equipment use.

Upland Opening Maintenance and Improvement: No treatments would occur under Alternative 1, and no soil compaction would occur. There would be compaction evident under Alternatives 2, 3 and 4 from the use of agricultural and fire control equipment. The effects of mechanical equipment use for prescribed burning and mowing would compact the upper soil horizon where fireline construction occurs; compaction would be local in scale and minor in extent because repeat passes along the same tread would not usually occur.

Transportation System and Recreation Uses: Under Alternative 1, soil compaction would be limited to increases in soil bulk density generated by vehicles in and along permanent road corridors. In some locations, the amount of compacted area would expand due to the development of by-pass roads to avoid wet pockets in the roadbed; in other locations, expansion of unclassified roads would also lead to additional soil compaction. There would be continued soil compaction occurring at parking locations along the permanent transportation system.

Under Alternatives 2, 3, and 4, soil compaction effects would be greater than under Alternative 1, principally from forest product hauling and the development of new and temporary roads. Soil compaction under permanent Forest and County roads cannot naturally be reversed (Powers et.al. 2005), and on some locations, would be enhanced by placing aggregate materials for user convenience or to protect improved (e.g., paved, gravel) roads from damage. Permanent County and Forest roads with native soil or aggregate surface materials would be used for hauling timber products, resulting in periods where increased compaction and rutting would occur on main haul routes.

Soil compaction under new and temporary roads can be reversed by using mechanical equipment to restore an affected areas' soil bulk density, and by revegetating these locations. The amount of time to restore the bulk density within the normal range would depend on the existing compaction levels, soil physical properties, and the type of vegetation re-occupying the site. Using an average of 10 – 12"' for the compacted width of these facilities, the area subject to long-term vehicle traffic would be greatest under Alternative 2, least in Alternative 4, and somewhat greater in Alternative 3 as compared to Alternative 2. The effects of soil compaction from transportation system uses are local in scale and minor in extent because unimproved roads and other temporary facilities occupy a very small amount of the Project Area.

Soil Productivity: Erosion

Accelerated erosion is the detachment and movement of soil by water and wind generated by human activities, thereby transforming soil into sediment. The potential for erosion is associated with vegetation treatments that expose mineral soil, or from roads and trails that are have little or no protection from the erosive effects of water and wind. Visual indicators of unacceptable erosion rates are rills or pedestals, deposition of soil, and steep/long slopes without vegetation (Soil Disturbance Field Guide 2009).

Forest Vegetative Management: Under Alternative 1, no areas of accelerated erosion would be generated because no areas would be harvested or non-commercially treated. Under Alternatives 2, 3 and 4, accelerated erosion caused by equipment use could occur on locations having loamy soil texture and slope > 6%; where the soil texture are sandy and slope < 6%, accelerated erosion is not likely to occur. The majority of the mechanically treated areas would continue to have a density of large trees, or quickly establish a dense cover of regenerating trees and herbaceous vegetation; the presence of this vegetation would be sufficient to stabilize, or re-vegetate, small areas of exposed mineral soil that occur. Landing sites and heavily-used skid trails would be susceptible to erosion because of exposure of mineral soils and inadequate vegetation cover in some of these locations; however, if surface infiltration is not impeded by compaction, adequate coarse woody debris is retained, and the skid trail has a slope <6%, the erosion hazard is slight. These effects would be greatest under Alternative 2, the least under Alternative 3, and between

these for Alternative 4, due to the increased volume of timber proposed for harvest and the increased number of associated skid trails and landing sites. These effects are expected to be local in scale and minor in extent because most clearcut and temporary facility areas would be located on soils with loamy textures and on slopes exceeding 6%.

Appendix A, Treatment Units, contains mitigation measures to reduce the adverse effects of compaction from road and temporary facility use.

Upland Opening Maintenance and Improvement: None of these activities would occur under Alternative 1. Under Alternatives 2, 3, and 4, accelerated erosion caused by equipment use would be minor, small in scale and of short duration because these sites are dominated by sandy texture and relatively flat terrain, and no exposed mineral soil would be generated by mowing. In addition, prescribed fire control lines using plowed lines would be temporary and established shortly before ignition, and after the prescribed burn has been conducted, the control lines would be leveled and seeded to restore herbaceous cover.

Transportation System and Recreation Uses: Under Alternative 1, the current transportation system would remain intact. Areas along existing roads would continue to be the most susceptible to erosion, especially where slopes exceed 2%, the ground vegetation is sparse to non-existent, and the amount of vehicle traffic is greatest. On most of these roads, micro-topography plays a key role. As the sandy soil from higher spots is washed off by precipitation, it settles in lower elevations. This, in conjunction with the erosive forces of vehicle tire treads, leads to the formation of gullies and wash-outs on some road segments. These areas are evident, and likely to be expanded, as a result of "go-arounds" developed by users. Intermittent maintenance by the Manistee County Road Commission on improved and native surface roadways is sufficient to control erosion sediments generated on Witala, Pole, and Hindman roads. Forest roads within the Project Area are native surface roadways and are generally located on slopes < 2% and have sandy textures that allow permits rapid percolation, which reduces runoff except under extreme conditions. Therefore, any accelerated erosion associated with these roads is local in scale and minor in extent.

Under Alternatives 2, 3 and 4, a new Forest System road (about 0.2 miles long) would be constructed. One Forest System road (FR 8044) about 0.4 miles in length is currently showing open on HMNF's Motor Vehicle Use Map; however, it has been closed years ago with an earthen berm. The MVUM would be changed to correct the status of this road. Portions of Forest System and County roads would be reconstructed made to improve access to treatment units, improve user safety, or to reduce accelerated erosion and compaction on permanent roads, and numerous short-term use roads and landings would be developed. Permanent roads would have surface application of aggregate materials on road sections with slope > 4% to reduce accelerated erosion to acceptable levels; short segments may be relocated in order to provide for better control of surface runoff. Temporary facilities located on slopes <2% would cause accelerated erosion that is local in scale and minor in extent while in use; when these facilities are revegetated, no appreciable accelerated erosion would occur. Appendix A, Treatment Units, contains mitigation measures to reduce the adverse effects of accelerated erosion from road and temporary facility use.

Soil Productivity: Organic Chemical Applications

Organic Chemical Applications: Table 3-11 illustrates the interaction that the herbicide proposed for use has with the soil, and pertains to Alternative 2, 3, and 4 **(**Tu et al. 2001).

Table 3-11: Herbicide Mobility and Persistence in the Soil

Herbicide	Mechanisms of Degradation	Half-life in the Soil	Mobility
Glyphosate	Degradation is primarily due to soil microbes.	Average of 47 days.	Glyphosate has an extremely high ability to bind to soil particles, preventing it from being mobile in the environment.

There would be no effects related to the spot-application of herbicides under Alternative 1. The use of glyphosate would occur under Alternative 2, 3 and 4 for the spot-treatment of small, dispersed locations of NNIS. The effects on soil productivity would be temporary and have minor adverse, local effects.

Cumulative Effects

The area of analysis for cumulative effects on soil productivity is the NFS lands where treatments would occur, because impacts of activities are generally restricted to treatment sites and impacts from agricultural, residential, and forestry practices to soil resource across adjacent public and private lands are not expected to be measureable.

The soil resources in the Project Area were impacted in the late 1800s and early 1900s through logging practices, the conversion of portions of this area to agriculture and rangelands, and periodic fire events. Reforestation efforts and timber harvesting operations also impacted the soils in the Project Area from 1935 to 2009. Since the early 1930s, soil productivity has generally been stabilized or improved because organic matter has been added to the soil profile by leaf litter and dead and decaying wood. Accompanying the increase of vegetative cover, root growth has increased water infiltration rates and the transport of nutrients associated with the organic matter to lower soil profiles. Generally, nutrients have accumulated in the humic layers or within the existing vegetation. Based on the site-specific soil characteristics, nutrients unused by the vegetation have either accumulated within the upper profiles or have leached out of the system. The overall effects of these events has fostered an increase in the overall level of soil productivity as compared to the 1930s, but reduced level when compared to native soil productivity.

Under Alternative 1, live vegetation on NFS lands would be retained; dead and down timber could be removed for use as firewood. As individual groups of trees, shrubs, and herbaceous species complete their life cycles, general levels of biomass and soil organic matter accumulation would exceed removals, and result in an overall increase in soil productivity.

Currently, areas of eroding and compacted soils occur on public and private roads, and on NFS lands that have had timber harvesting activities in the recent past. The effects from harvesting activities are most severe on the soils receiving concentrated equipment use, such as skid trails and landing sites. Soil compaction, rutting, puddling, and erosion would continue to occur on roads that would be left open to motor vehicle use. The soils that are impacted by timber harvesting, mechanical tree planting, fire, log landings, and skid trails would slowly recover through natural processes. Natural rehabilitation assumes that soil damage resulting from past management activities has not surpassed the physical thresholds of the soil systems and that partial or complete vegetative cover was maintained. The most severely affected locations (permanent roads, and legal and illegal motorized vehicle use areas) would continue to be adversely effected until they are reconstructed with specific design standards, relocated or eliminated.

Conclusion: The duration and magnitude of no action would incrementally add to past, present and reasonably foreseeable capability of soil(s) to produce specified plants or plant succession (soil productivity) within the Project Area, primarily by conserving soil organic matter and top-soil, and retaining continuous herbaceous and forest canopy vegetation.

Under Alternatives 2, 3, and 4, it is likely that other activities would occur in the future that could affect soil resources. Live vegetation would be treated with a variety of management activities; dead and down timber could also be removed for use as firewood. As individual groups of trees, shrubs, and herbaceous species are felled or otherwise complete their life cycles, general levels of biomass and soil organic matter accumulation would exceed removals, except for commercially harvested areas. The range of rotation lengths are 45 to 100 years; however, final harvest may occur when the culmination of mean annual increment (CMAI) is attained at the stand level (HMNF 2006). Rotation lengths in this range, which would be typical for the forests in the Project Area, would allow for natural recovery of soil productivity.

Management unit soil productivity would increase in areas not harvested, and would not be reduced where stem wood and a portion of branch wood and leafy materials are retained on site in commercially harvested units. Soil productivity in areas subject to repeated, intensive commercial treatments, e.g., clearcut and shelterwood treatments, would be reduced in the short-term where stem wood and the majority of branch wood and leafy materials are removed (Stone 2002). However, these treatments would be implemented on a sufficiently long rotation i.e., 45+ years, and would therefore mitigate nutrient depletion. As these forested areas regenerate and/or continue to mature during the ensuing decades, organic matter would accumulate and replenish exported nutrients. All areas, including stands to be less intensively treated, would receive atmospheric inputs (especially nitrogen) and biotic accruals that would sustain soil productivity and further mitigate nutrient depletions (Ranger and Turpault 1999). In addition, retention of hardwood topwood would conserve organic matter throughout the Project Area. Soil productivity on NFS lands would be protected or slightly enhanced by ensuring that continuous vegetation canopies, dominated by either forest or herbaceous species, follow natural or anthropological disturbances.

Management of the transportation system is expected to provide access for motor vehicles on a variety of road types. These roadways would be maintained or improved by Manistee County or the Forest Service. Most permanent Forest roads are expected to be designed, constructed, and maintained as single lane, primitive-type facilities intended for use by high clearance vehicles; graded or unimproved Manistee County roads are similar to the typical Forest road. Soil compaction, rutting, puddling, and accelerated erosion would continue to occur on those roads open to vehicle use, but be corrected by maintenance or local improvements. The most severely affected locations are permanent roads and legal and illegal motorized vehicle use areas; these would continue to be adversely affected unless maintained within design standards, relocated, or eliminated.

Areas of eroding and compacted soils occur in some timber harvest areas (especially skid trails and landings that have received concentrated equipment use). These impacts, caused by harvesting, mechanical planting, prescribed fire, landings, skid trails, would recover, at various rates, through natural processes if critical physical thresholds were not exceeded during historic, or are not exceeded in the future, and vegetation cover is maintained.

Conclusion: The duration and magnitude of Alternatives 2, 3, and 4 would incrementally add to past, present, and reasonably foreseeable capability of soil(s) to produce specified plants or plant succession (soil productivity), primarily by conserving soil organic matter and top-soil, retaining sufficient amounts of these elements so that existing soil productivity is sustained following intensive treatment, and by promoting/retaining continuous herbaceous and forest canopy vegetation.

Air Quality

Existing Condition

The entire State of Michigan is currently in attainment for emissions of carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, lead, and particulate matter into the airshed (Michigan Department of Environmental Quality 2009). The primary source of these air pollutants are manufacturing, coal combustion, waste incineration, dust, and vehicle emissions, the majority of which are transported from distant point and non-point sources to the Project Area (Ibid); mercury deposition remains a problem in the Project Area, but is not a result of Forest Service activities. Particulate matter less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) is generated by open combustion of forest vegetation, i.e., wildfires and prescribed fires (Michigan Department of Natural Resources 2006). The Project Area is not in a priority I or II area regulating emissions of particulate matter into the airshed (Michigan Department of Environmental Quality (MDEQ) 2007).

Direct and Indirect Effects

Under Alternative 1, there would be no new management activities occurring under this alternative; therefore, there are no direct or indirect effects to the local airshed. Air quality would be slightly affected by exhaust emissions which contain particulates and oxides of nitrogen and sulfur; and by similar emissions, including ozone, generated from distant sources, primarily by fossil fuel power plants, vehicles, and subsequently transported to the Project Area.

If a high-intensity wildfire were to occur in the Project Area, the effects on the airshed would be extensive, but of relatively short duration. There would likely be a large input of smoke to the airshed resulting in an extensive increase in the negative impacts from large amounts of smoke that contain PM_{10} and $PM_{2.5.}$ These particulates cause and/or exacerbate negative health effects for those people located downwind from the fire, cause smoke on roadways, and trigger odors throughout the downwind area. The longevity of the impacts would be of fairly short duration, and can be mitigated by reducing or eliminating exposure to the smoke.

Under Alternatives 2, 3, and 4, vehicle emissions and dust generated by timber harvesting equipment and heavy trucks would have minor adverse, local effects on air quality (Liu 2004); no appreciable difference exists among these alternatives from motor vehicle emissions. Carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, lead, and additional particulate matter would continue to be generated within, or transported into, the immediate environment. The sources are mainly fossil fuel power plants and vehicles from metropolitan areas upwind of the Project Area.

Broadcast burning in these upland opening grass fuels would comprise all three combustion stages: flaming, smoldering, and residual. Flaming combustion is the most efficient type of combustion and usually tends to emit the least amount of pollutants compared with the mass of fuel consumed. Smoldering combustion is common in duff and woody material with high fuel moisture content; consequently, combustion efficiency is lower, resulting in more particulate emissions generated than during the flaming stage. Residual combustion is an independent process following the flaming stage, and is characterized by little smoke and is composed mostly of carbon dioxide and carbon monoxide (USDA Forest Service 2002). The prescribed burning activities in upland openings would cause localized impacts to air quality for short time periods, where the greatest amount of smoke generated occurs for 1 – 2 hours while the active burning and smoldering phase continues. The air quality would be reduced immediately downwind from where the smoke is generated, and where it contacts the ground again, if little smoke dilution in the atmosphere occurs prior to this settling.

Prescribed burns of this nature are typically carried out in the spring through fall seasons, and are less than 12 hours from time of ignition to time of extinguishment, or when combustion ceases. The proposed prescribed burn method would be of light to medium intensity, e.g. 7 – 388 Btu/ft/sec, and would consume the 1 and 10 hour time lag fuels (less than 1" in diameter). Prescribed burning activities would occur during that part of the day when local climate and fuel moisture levels indicate a near 100% consumption of these fuels. During the time of the burning activities, smoke and particulate matter would be introduced into the local airshed. The amount and duration would be dependent on the scale and intensity of the prescribed burning activities; however, tests indicate that, on average, 90% of smoke particulates generated by wildfires and prescribed fires are PM_{10} and 70% are $PM_{2.5}$ (MDNR 1998). Persons located downwind from these activities and personnel conducting and controlling the prescribed fire, would be affected by these particulates. The activities proposed would likely occur through a series of independent prescribed burns occurring over a period of several years.

The type of fuel to be burned and weather conditions would also affect air quality in the Project Area. Grass fuels are most readily consumed, and fuels of any diameter are more fully consumed, when precipitation and relative humidity result in target fuel moisture less than 10%; however, live fuels and fuels larger than 3 inches in diameter are less responsive to short term weather conditions, and have greater fuel moisture contents. Wind speed affects consumption of all fuel sizes by increasing the amount of oxygen and

preheating fuels adjacent to burning materials. Therefore, prescribed fires conducted with higher wind speeds and low fuel moisture content consume more fuel, are characterized by greater flaming combustion, and lesser amounts of smoldering combustion, than prescribed fires conducted under moderate weather and higher fuel moisture content conditions.

Each prescribed burn may be conducted in part or whole, separately, or in conjunction with other burn treatments. It is important to note that the total number of acres to be burned would be predetermined in the Project Area; however the actual number of acres each day would determine how much smoke is produced in each burning period and how much smoke is produced from individual treatment sites. Smoke production and its effect on local air quality would, therefore, be related to the amount of prescribed fire treatment, from ignition until residual combustion is completed. Planned prescribed burn conditions usually coincide with short-term weather patterns, thus producing a pulse of smoke that would impact air quality for 1-5 days in a row. If the all three combustion stages are of short duration, local air quality may be impacted once in a week; conversely, 3-5 prescribed fires may occur during prolonged periods of favorable weather conditions. In addition, each prescribed fire is influenced by ability of firefighters/equipment to simultaneously conduct prescribed burns and respond to wildfires, and the number of on-going wildfires and those prescribed fires remaining in the smoldering and residual stages of combustion. Therefore, distribution of air quality effects can vary within the analysis area, with direct effects would range from pronounced within new prescribed fire ignitions to less where combustion is ongoing. The effects of smoke inhalation are detrimental, primarily from breathing air containing particulate matter smaller than 10 microns, and also from carbon monoxide. Negative effects can be reduced or eliminated by wearing protective devices if directly exposed to smoke (self contained breathing apparatus), by minimizing direct exposure to smoke (remain out of direct contact or contact smaller concentrations of particulates and gases), or by eliminating exposure to the smoke.

Appendix A, Treatment Units, contains mitigation measures to reduce the adverse effects of broadcast prescribed fire use in upland openings. In addition, a prescribed burn plan is developed for each area to be treated that includes acceptable and unacceptable burning conditions, including wind factors that would minimize the impacts downwind of the prescribed fire. Prior to any prescribed burn ignition, actual fuel and weather conditions are compared to those identified in the prescribed burn plan and used to assess the direction the smoke would travel, how high in the atmosphere the smoke would be lifted, and how it would be dispersed by surface and transport winds.

Cumulative Effects

The analysis area for cumulative effects of the treatments on air quality is Manistee and Wexford Counties. This area was selected because particulates and gases that affect air quality are generated within, or transported to, these counties.

Alternative 1 would not affect air quality within the Project Area. Motor vehicle use associated with transportation and motorized recreation would likely increase in the future, increasing emissions from these vehicles. There would be no emissions generated by vegetation treatments; however, downwind transport of pollutants generated elsewhere would also continue to affect this vicinity. If a large scale wildfire were to occur, large amounts of smoke, with accompanying particulates and pollutants, would impact adjacent downwind (short distance) and smoke dispersal (long distance) areas. These events would likely happen during the period March-November and could impact any area in the vicinity, depending on environmental factors such as wind speed and direction and atmospheric stability (inversions).

Under Alternatives 2, 3, and 4, there would be short-term adverse effects to air quality, primarily for those areas downwind from prescribed burn treatments. The prevailing transport winds (1500+ feet elevation) in this part of Michigan come from the west during the growing season and from the north during the non-growing season months. Communities and individuals downwind, i.e. east or south of areas to be burned, would have the air quality reduced below ambient standards. Those communities and individuals closest to

the prescribed fire areas would potentially be more exposed to microscopic particles and carbon monoxide and other gasses than those persons in areas where mixing with the atmosphere dilutes these pollutants. Other prescribed burning and wildfires would also reduce local air quality; however, because of the proximity of the Project Area to Lake Michigan, private land features, and prevailing winds, these events are unlikely to occur and diminish local air quality beyond ambient conditions (MDEQ 2007). Motor vehicle use associated with transportation and motorized recreation would likely increase in the future, increasing emissions from these vehicles throughout the Project Area. There would be short-term increases in emissions (Liu 2004) related to NFS land treatments; however, downwind transport of pollutants generated elsewhere would continue to be the prevalent impact to air quality in the Project Area. Smoke management plans that incorporate EPA guidelines (MDNR 1998) would reduce emissions from individual and aggregate prescribed fire treatments. The emissions generated by the proposed prescribed fire treatments would be generated within counties currently in attainment for carbon monoxide and particulates less than 10 microns in size (MDEQ 2007). It is likely that other private and public activities, such as commercial and residential developments that emit pollutants, would occur in the future that could diminish local air quality.

There would be short-term increases in emissions generated by infrequent forest management practices, and as the local population increases, long-term vehicle emissions would increase; however, downwind transport of pollutants generated elsewhere would continue to be the primary source in the analysis area. If a large scale wildfire were to occur, large amounts of smoke, with accompanying particulates and pollutants, would impact adjacent downwind (short distance) and smoke dispersal (long distance) areas. These events would likely happen during the period March-November and could impact any area in the vicinity, depending on environmental factors such as wind speed and direction and atmospheric stability (inversions).

Conclusion: The duration and magnitude of Alternative 1 would not incrementally add to past, present, and reasonably foreseeable smoke and particulates generated within Manistee and Wexford Counties. The duration and magnitude of Alternatives 2, 3, and 4 would incrementally add to past, present, and reasonably foreseeable smoke and particulates.

Water Quality

Existing Condition

The Project Area is included in portions of the Manistee River and Bear Creek watersheds and includes the subwatersheds of Eddington Creek, Bear Creek, Tippy Dam Pond, and Hinton Creek. The acreage of the four subwatersheds totals 89,991 acres which is about 141 square miles. The average amount of open acres in these four subwatersheds totals 18,898 acres which is an average of 21% open or 79% forested.

As mentioned in the soils description, the Project Area consists of a variety of soils, but mostly they are well to excessively well drained sandy soils, which are highly permeable. This high permeability reduces runoff, enhances water filtration, and leads to a high proportion of groundwater input into streams that ultimately lead to stable flow regimes.

The Direct and Indirect Effects

Alternative 1

There would be no direct or indirect effects resulting from National Forest management activities. However, if no activity was undertaken and if a large scale wildfire were to occur, the effects on the watersheds of the Project Area could be extensive. With the increased potential for soil erosion and loss of nutrients, lake and streams of the area could experience increased sediment loading, and mobile nutrients (nitrogen especially) could be leached into the ground water. In addition, this increased soil erosion could also result in increased nutrient inputs into lakes and rivers of the Project Area, which could result in algae

blooms that would negatively impact plant and animal resources of these water bodies. All these effects have the potential for long-term damage to water resources of the Project Area.

Road maintenance and improvements within the Project Area are the responsibility of the Manistee county road commission and the Forest Service. The network of public roads degrades water quality by providing non-point sources of sediment and other pollutants into the waterways of the Project Area; these problems are caused either by location (roads adjacent to permanent water sources) or maintenance practices, such as channeling runoff. Private roads are numerous throughout the Project Area, and contribute to these same effects.

Direct and Indirect Effects

Alternative 2

Large amounts of non-forest and young forest lands can contribute more sediment to streams and cause higher peak flows from surface runoff that leads to stream bank erosion and increased water temperatures. The Forest Plan (II-6) provides direction that the total openland habitat within sixth level watersheds should generally not exceed 66%. The average amount of openland in the four subwatersheds within the Project Area totals 18,898 acres which is an average of 21% openland. The 66% threshold for the allowable amount of openland acreage within these four subwatersheds is approximately 59,394 acres.
Under Alternative 2 approximately 452 acres of temporary openings would be added to the amount of openland and young forest, spread across the four subwatersheds found in the Project Area. For these four subwatersheds, the amount of open acres added (452) represents less than 1% of the available forestland that could be converted to openland without affecting water quality. The amount of temporary openings and young forest added to these waterhseds under Alternative 2 are miniscule when compared to the amount of surplus forest available for conversion, before the 66% threshold is reached. It is also important to note that much of this acreage would regenerate back to a forested state and thus move out of this category approximately 15 years after harvesting.

The duration and magnitude of public road use, the low amount of road construction, and maintenance activities would incrementally add to the sedimentation and erosion effects of past, present and reasonably foreseeable activities in the watersheds. The road reconstruction activities would improve sedimentation and erosion impacts to the watershed. None of the 6th level watersheds and subwatersheds within the Project Area are approaching exceeding 66% openland habitat. Therefore, it is unlikely this project would have detrimental impacts on water quality attributable to non-forest and low density/regenerating forestlands.

Direct and Indirect Effects

Alternative 3 and 4

Under Alternative 3 and 4 approximately 267 and 360 acres respectively would be added to the amount of openings and young forest, spread across the four sub watersheds found in the Project Area. Alternative 3 and 4 would add fewer acres of openings to the watershed than Alternative 2, with a commensurate reduction in the length of temporary roads and numbers of landings constructed; therefore, resulting in a decreased impact on the watershed.

Cumulative Effects

The analysis area for cumulative effects on water quality is the entire area of the Eddington Creek, Bear Creek, Tippy Dam Pond, and Hinton Creek subwatersheds. The Project Area is entirely within these watersheds and therefore any impacts to water resources would be limited to these watersheds.

A variety of projects, designed to reduce the impacts of a permanent public road system on water quality have occurred in the watersheds in the Project Area, such as improving or reconstructing damaged roadways, culverts and bridges. On-going and future projects would concentrate on improving water quality by reducing sediment delivery and stream bed-load, and reconstructing damaged or obsolete public transportation system components.

The Marilla Too Project would add a maximum of 437 acres (Alternative 2, 3, and 4) of young forest or temporary openings to the watersheds in the Project Area. Further timber harvest and/or opening creation projects in the area of these four watersheds are unlikely to exceed the allowable surplus acres that could be converted to openings or young forested stands. It would take a substantial amount of additional openland creation projects much larger than what is currently envisioned for the area to begin to have a detrimental effect on the watersheds. Even considering activities on private land that could result in a reduction of the surplus acres, the changes would have to be widespread in order to approach the threshold of 66% open. Therefore, it could be safely assumed that the long-term cumulative effects on the water quality of both of the watersheds found in the Project Area would be minimal.

The duration and magnitude of public road use, the low amount of road construction, and maintenance activities would incrementally add to the sedimentation and erosion effects of past, present and reasonably foreseeable activities in the watersheds. The road reconstruction activities would improve sedimentation and erosion impacts to the watershed. Adherence to Forest Plan standards and guidelines and site specific mitigation measures would reduce sedimentation and erosion impacts to adjacent riparian areas and water sources and not result in appreciable changes to existing rates of sediment delivery into these areas. The duration and magnitude of timber harvesting, land use, and cover type conversion activities could incrementally add to the water temperature effects of past, present and reasonably foreseeable activities in the two watersheds.

RECREATION AND VISUAL QUALITY

Existing Condition

The National Forest and public lands within and near the Marilla Too Project Area are frequently used by visitors seeking a variety of recreation opportunities.

A wide diversity of trail systems traverses the Project Area including:

- North Country National Scenic Trail (NCT)
- Manistee-Benzie Snowbirds Snowmobile Trail System

Other recreation facilities in or nearby the Project Area include:

- High Bridge River Access (Manistee River)
- Red Bridge River Access (Manistee River)
- Suicide Bend River Access (Manistee River)
- Tippy Dam State Forest Campground and River Access (DNRE)(Manistee River)

In general, areas with high use levels are the High Bridge and Red Bridge River Access Sites on the Manistee River; both are just outside of the Project Area. Suicide Bend and Tippy Dam State Forest campground receive moderate use. The snowmobile trail and North Country National Scenic trail also have high use levels but for a shorter time periods; during winter good snow periods and summer weekends and holidays respectively.

Summer recreational use includes hiking, mountain biking, driving for pleasure, and nature viewing. Other visitor uses in the area include firewood gathering, and wildlife or bird viewing. There is only one Special Use Recreation Event, along the North Country National Scenic Trail (NCT), permitted within the Project Area. This early June running-relay event has from 200-250 participants and spectators.

During the spring and fall, the Project Area is moderately visited by anglers, wildlife hunters, dispersed campers, fall color viewers, hikers, mountain bikers, mushroom hunters and people driving for pleasure. The few dispersed camping locations within the Project Area are mostly along Upper River Road and the snowmobile trail in the Red Bridge Hills. They are most often used during the fall hunting and spring or fall fishing seasons.

Winter recreation use includes cross-country skiing, snowshoeing, and snowmobiling. Snowmobilers ride the trail that traverses the Marilla Too Project Area. More than 20 miles of designated snowmobile trail exists within and bordering the Project Area on NFS lands. These snowmobile trail segments are maintained by the Manistee-Benzie Snowbirds (Snowmobile Association) under an agreement with the Forest Service and a grant from the Michigan Department of Natural Resources (MDNRE).

Recreation Site Information

High Bridge and Red Bridge are busy river access locations with boat launches and parking areas. High Bridge access, which is snowplowed and open for use all year, is also used by NCT hikers, and as snowmobile parking.

Scenery Management and Scenic Integrity

The Forest Service utilizes the Scenery Management System to inventory, manage, and assess impacts to visual resources on NFS lands (Forest Plan-Appendix A). This system establishes three Scenic Attractiveness designations; Distinctive (Class A), Typical (Class B), and Indistinctive (Class C). The Marilla Too Project Area encompasses 19,757 acres, and is one of the few local areas with topography. There are several Distinctive (Class A) areas inventoried within the Project Area. The Class A Scenery occurs; west of the Manistee River on the ridge north of Coates Highway and along the ridge south of Beers Road, also along the creek west of High Bridge Road and north of River Road. Class A Scenery is also found along the Manistee River, just outside the Project Area. The Project Area mostly encompasses Typical or Indistinctive classes. A designation of Typical scenic attractiveness means that the landscapes provide ordinary or common scenic quality.

Another element of the Scenery Management System is Scenic Integrity. Scenic Integrity indicates the degree of intactness and wholeness of the landscape character. The Marilla Too Project Area is located in a hilly landform with few flat areas. Landscape is comprised mostly of forested lands. The forested areas are a mix of deciduous and coniferous trees common to this part of Michigan. The area includes row planted red pine from the 1930s and 1940s. Private and NFS lands have been modified over the last century. Private lands have been cleared for agricultural and residential uses. Lands within the Project Area owned by the Little River Band of Ottawa Indians were logged in 2010. Most of the area NFS lands were logged at one time. Since the early 1900s, forests have become re-established by tree planting and natural regeneration. Plantations of red pine stands in the Marilla Too Project Area may be unnatural appearing, with a noticeable row effect and little horizontal and vertical diversity. Many were planted by the Civilian Conservation Corps (CCC) in the late 1930s, with stock from the historic Chittenden Tree Nursery in Wellston. Other past and present impacts of humans on the landscape are visible, giving the area a low to moderate scenic integrity.

Although the area is heavily used by recreationists and trail users, documented concerns were about how logging operations affect the trails and concern slash removal. Overall, the public has accepted aspen clearcutting, over story removal, prescribed burning, red pine thinning, and wildlife opening creation as necessary forest practices.

Direct and Indirect Effects

Alternative 1

Under Alternative 1, no vegetative treatments or other management activities would occur in the Marilla Too Project Area on NFS lands. Some activities, such as minor road and trail maintenance, would continue. Selection of Alternative 1 does not preclude future analysis or implementation of on-going management proposals within the Project Area.

Recreational use of NFS lands inside and adjacent to the Marilla Too Project Area are expected to remain at current levels with slight fluctuations due to numerous factors such as economic trends and changes in use patterns. Opportunities for viewing and hunting of wildlife species favoring early successional habitat would decline due to a decline in vegetation diversity. Openings for dispersed camping along forest roads are expected to decline due to encroachment of vegetation into openings. Morel mushroom and berry gathering may also change over time with vegetative changes.

There would be some change in the Scenic Attractiveness or Scenic Integrity levels within the Project Area under this alternative. The visual quality of the area would remain relatively consistent with the current condition. The landscape of the Project Area is expected to remain a mix of residential and forested areas. Slight visual changes are expected over time as natural succession or environmental events, such as windstorms, alter the vegetative composition. Throughout the Project Area, red pine plantations would remain monocultures, continue to appear overstocked with small diameter trees, and have an unnatural plantation row appearance. The desired condition of increased vegetative diversity and more natural looking stands would not be achieved. Aspen stands in the Project Area would slowly convert to hardwood species. Opportunities for viewing and hunting of wildlife species favoring early successional habitat would decline. Openings for dispersed camping along forest roads would be reduced as trees and vegetation mature, reducing camping opportunities.

There would be no change to the amount of open roads available for public use for access to recreational activities.

Alternatives 2, 3, and 4

Impacts to recreation and visual resources with Alternative 2, 3, and 4 are expected to be similar. Vegetative changes from timber sales may have a short-term affect on trails, dispersed camping, morel gathering, and hunting, as well as Scenic Attractiveness levels. The sights and sounds of logging activities may be readily noted by recreationists for short periods of time. Walking through areas impacted by management activities may be more difficult due to the presence of slash and stumps. The long-term effects would be an increase in hunting and wildlife viewing opportunities due to creation of a more diverse forest with openings and improved habitat for game species.

Timber harvest activities usually have a short-term negative impact on visual quality; however, in the long-term, the proposed treatments would create some desired visual effects. Specialized treatments would mitigate some of the visual impacts, as described in Appendix A. Slash would be removed for 25 feet from trails, roads, and private property. Trail crossing by logging equipment would be kept to a minimum and occur at selected locations. Logging activities would be scheduled to minimize impacts to snowmobile trail users. Warning signs would be posted along trails during active logging operation. These mitigation measures would reduce the imacts of the timber harvest activities on trails (see Appendix A).

The pine thinning treatments would open the canopy, enable native hardwood vegetation to become established in the understory, and promote vegetative and structural diversity. The creation of a hardwood understory would create vertical diversity within the stands that would reduce the visible row effect. The

plantation appearance of the red pine trees would be less apparent after the thinning operations and would give the area a more natural appearance.

Photo 3-4
Plantation Red Pine Stand
Visible Rows and Low Vegetative Diversity

Photo 3-5
Thinned Red Pine Stand
Hardwood Understory Becoming Established

The clearcuts and overstory removal treatments would create the most obvious changes in scenic quality. After harvesting, these stands would be fairly open. Within three years of harvesting, a relatively dense understory is expected to become established. Snags and reserve trees would be retained to provide structural and visual diversity with the harvest units. Photos 3-1, 3-2, and 3-3 display an example of a mature aspen stand proposed for clearcut treatment and age classes after harvest. Overall, the short-term negative visual impacts from the regeneration harvests are expected to be outweighed by the long-term enhancement of the visual diversity created by varying the age classes of vegetation. Recreation opportunities for hunting and wildlife/bird viewing would be enhanced.

The majority of the wildlife habitat improvement projects include opening maintenance treatments, such as mowing, brushing, or prescribed burning. The opening maintenance treatments would maintain the existing upland openings in a non-forested condition. These openings provide visual diversity and a contrast from the surrounding forested stands. They are expected to have little or no impact on trails or recreation.

An additional open public road would be added to the MVUM, slightly increasing public access to NFS land. Temporary specified roads would be developed to access treatment units to facilitate harvest activities and closed after logging operations. Road reconstruction activities would occur on Forest System and County Roads to improve access to the treatment units. These road activities would impose short-term visual impacts because of the cleared vegetation, exposed mineral soils, noise and presence of heavy equipment. Visual impacts would decline as these areas become revegetated. Sites used as landings would be rehabilitated after the harvest operation is completed to promote revegetation and reduce compaction and erosion potential.

Based on previous experience with area projects of this nature, the public would accept changes in the Scenic Attractiveness and Scenic Integrity levels within the Project Area, under all of the action alternatives. Recreation opportunities for hunting and wildlife/bird viewing would be enhanced.

Cumulative Effects

The analysis area for cumulative effects for this resource includes NFS land and private lands within 5 miles of the Marilla Too Project Area boundary. This area was chosen because it includes the trail systems and campgrounds referenced in the recreation section.

Under Alterative 1 recreation use levels and opportunities in and around the Project Area are expected to remain at current or reduced levels. The visual quality of the area would remain relatively consistent with the current condition. The landscape of the Project Area is expected to remain forested. Slight visual changes are expected over time as natural succession or environmental events, such as windstorms, alter the vegetative composition. Throughout the Project Area, red pine plantations would remain monocultures, continue to appear overstocked with small diameter trees, and have an unnatural plantation row appearance. The desired condition of increased vegetative diversity and more natural looking stands would not be achieved. Aspen stands in the Project Area would slowly convert to hardwood species.

Under Alternatives 2, 3, and 4 recreational use of NFS lands inside and adjacent to the Project Area are expected to remain at current or increased levels with slight fluctuations due to numerous factors such as economic trends and changes in use patterns. Opportunities for viewing and hunting wildlife species favoring early successional habitat would improve due to vegetation diversity. Openings for dispersed camping along open forest roads are expected to remain at current levels. The visual quality of the area would be improved with vegetative diversity.

Similar projects have occurred near the Project Area in the past. A series of aspen clearcuts occurred near the Project Area adjacent to the snowmobile trail. Additional regeneration treatments and prescribed burns are planned in the area to improve age class diversity and would continue to be visible and scattered throughout and adjacent to the Project Area. Similar vegetative treatments are likely to be conducted on NFS and nearby private lands. The HMNF would continue to implement vegetative treatments, adding to the visual diversity of the area.

HERITAGE RESOURCES

Existing Condition

Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effect of a project on any district, site, building, structure, or object that is included in, or eligible for inclusion in, the National Register of Historic Places. The Archeological Resources Protection Act (ARPA) covers the protection of archeological resources on public lands or Indian lands. The federal government has trust responsibilities to tribes detailed in Section 106 consultation as well as government-to-government relationships to ensure that tribal rights are protected. Consultation with tribes helps ensure that these trust responsibilities are met. The HMNF consulted with potentially affected tribes and no tribal concerns were identified for this project. A heritage resource survey was conducted in the Area of Potential Effect, in accordance with the HMNF's heritage resource guidelines.

Heritage resources are the physical remains left by people who occupied or visited the land now encompassed by the forest during prehistoric and historic times. These are fragile, non-renewable resources. They include, but are not limited to prehistoric and historic Native American settlements, logging industry related resources, Euro-American pioneer farms or homesteads, and former villages and towns.

Effects Common to All Alternatives

The known heritage resource sites would be protected as recommended by the Huron-Manistee National Forest's Zone Archeologist, and in accordance with State Historic Preservation Office guidelines. Mitigation measures used to avoid disturbance to the sites would be applied to all action alternatives. These heritage resource mitigation measures are incorporated into the treatment units they are found in (see Appendix A). If any unknown heritage resource sites are identified during project implementation, then the project work would stop and a Forest Cultural Resource Professional must be contacted. Project work in this area would not be allowed to resume until the heritage resources in question have been documented and the site area is preserved from any potential impacts. All identified cultural resources within the Project

Area would have been documented, protected, and/or removed from the Area of Potential Effect. No cumulative effects to heritage resources are expected from these actions.

TRANSPORTATION ANALYSIS

Existing Condition

Field reviews were conducted to determine if the transportation system in the Project Area provided adequate access for the proposed management activities. Open public Forest System and county roads and closed Forest System roads (Level 1 roads) were evaluated for access and the Motor Vehicle Use Map (MVUM) was also reviewed.

Road density was calculated for all open public roads regardless of ownership within and bordering the Project Area. Road density is the measure to which road miles occupy a given land area. One mile per square mile is one mile of road within a given square mile. The majority of the Project Area is within Roaded Natural Management Areas (MA 2.1 and 4.2). Management Areas 4.4 (Rural), MA 6.1 (Semiprimitive Nonmotorized), and MA 8.1 (Wild and Scenic Rivers) are also included in the Project Area. Forest Plan management direction for the transportation system within the Road Natural and Rural Management Areas is a maximum of 3 mile of road per square mile (Forest Plan, page II-39 and II-40). Management direction for the transportation system within Semiprimitive Nonmotorized Areas is a maximum of 1 mile of road per square mile (Forest Plan, page II-39 and II-40). No management activities are proposed in MA 6.1 and 8.1.

The Project Area includes about 75 miles of open public roads, including Forest System roads, and Manistee County, within or on the boundary of the Project Area (see Table 3-12 and Table 2-1 on page 2-13 of the EA). Most forest roads in the Project Area have had low levels of road maintenance, and some are in need of reconstruction for access to timber harvest units and other management activities. Some new road construction is needed for access while some open roads are not needed for administrative purposes or access.

Public use of roads within the Project Area is moderate, except during the spring game and mushroom hunting and fall hunting seasons, when use is moderate to heavy. More than 20 miles of designated snowmobile trail exists within and bordering the Project Area on NFS lands. The designated motorized and non-motorized trails are discussed in the Recreation section of the EA.

Direct and Indirect Effects

Alternative 1

Under Alternative 1, there would be no changes made to the roads and motorized access in the Project Area. The Forest System roads would continue to be minimally maintained. There are roughly 75 miles of existing public roads open within the Project Area, which includes Manistee County, and Forest System roads within and bordering the Project Area. This equates to about 2.43 miles of road per square mile (see Table 3-12 and Table 2-1 on page 2-13) and meets the Forest Plan management direction for the transportation system for Roaded Natural and Rural MAs.

The effects of this alternative would be that the public would continue to be able to utilize the current roads and have motorized access throughout the Project Area. People using the Project Area for access to motorized recreation, such as driving for pleasure along roads or for snowmobile trail riding, would not experience displacement or loss of access. Other recreational activities in the Project Area, such as hunting, camping, hiking, cross-country skiing, mountain biking, and mushroom gathering would not likely change.

Table 3-12: Transportation System in the Marilla Too Project Area

Road Activity	Alternative 1	Alternatives 2, 3, 4
Miles of Open Public Road	75.1	74.9
Road Density (miles of road/square mile)	2.43	2.43
Miles of New Open Public Road Construction	0	0.20
Miles of New Temporary Road Construction (closed after harvest)	0	1.3
Miles of Public Road Closed (MVUM correction)	0	0.4
Miles of Open Public Road Reconstructed for timber access	0	7.0
Miles of Open Public Road Reconstruction as Potential Capital Investment Projects	0	5.9
Miles of Temporary Road Reconstructed for timber access (closed after timber harvest)	0	2.2

Alternatives 2, 3, 4

Under Alternatives 2, 3, and 4, approximately 0.2 miles of Forest System road would be constructed to access timber harvest units and would remain open to the public. This new road would access treatment unit 413/5 and provides additional public and administrative access to NFS land in that area. This new road would be added to the MVUM as an open public road. One Forest System road (FR 8044) about 0.4 miles in length is currently showing open on HMNF's Motor Vehicle Use Map; however, it has been closed year ago with an earthen berm. The MVUM would be changed to correct the status of this road. Although this road would be taken off of the MVUM as an open public road and there would be a reduction in open public roads, this road has been closed for awhile and has not been providing public access.

Approximately 7.0 miles of open public road and 2.2 miles of temporary road would be reconstructed to improve access to timber harvest units. Portions of Pole Road (County Road), Witala Road (County Road), and Forest System Road 5481 (about 5.9 miles in length) are potential Capital Investment Projects that may include cooperative assistance from Manistee County Road Commission. Special funding opportunities for these road reconstruction Capital Investment opportunities would be pursued. Under Alternatives 2, 3, and 4 the proposed road reconstruction of public roads would improve motorized access to NFS lands and improve motorized recreational opportunities. The road improvements associated with the timber harvest would maintain the condition of the road and eventually improve motorized access.

Portions of haul roads (specified roads) need to be constructed, reconstructed, or improved to access the harvest units and for timber hauling. Minor adjustments in road clearing limits, realignment of the existing roads, and stabilization in some locations may be necessary to reduce the erosion potential. Road access may be restricted during active timber sale activity. The road improvements associated with the timber harvest would maintain the condition of the road and eventually improve motorized access.

As under Alternative 1, under Alternatives 2, 3, and 4 there are about 75 miles of existing public roads open within the Project Area, which includes Manistee County, and Forest System roads within and bordering the Project Area. This equates to about 2.43 miles of road per square mile (see Table 3-12 and Table 2-1 on page 2-13) and meets the Forest Plan management direction for the transportation system for Roaded Natural and Rural MAs. No management activities are proposed in MA 6.1 and 8.1.

Cumulative Effects

The cumulative effects analysis area includes the transportation system across the Huron-Manistee National Forests. This area was chosen because these are the lands and roads where the Transportation System is managed on NFS lands.

Currently, the roads in the Project Area are used for access to administrative management activities, access to private property, and for motorized recreational access to NFS lands. The Huron-Manistee National Forests is implementing the national direction outlined in the Travel Management Rule. We have been validating road management standards and updating our GIS system with information on road locations and conditions across the HMNF. The Huron-Manistee National Forests provides Motorized Vehicle Use Maps (MVUM) showing roads which are open to motorized travel. Routes not shown on the MVUM are not open to public motor vehicle travel. This Motor Vehicle Use Map is updated annually to correct mapping errors and update travel management decisions on National Forest System lands.

NFS lands located adjacent and near the Project Area provide similar motorized access and recreational opportunities to those that occur within the Project Area. Additional motorized opportunities on snowmobile and motorcycle trails are located outside the Project Area on NFS and state lands. These areas provide motorized recreation similar to that currently available in the Project Area.

There are no major expected changes in land uses on NFS lands within the Project Area. Private land encompasses about 33 percent of the land base in the Project Area. Increases in development on private lands adjacent to the Project Area are expected in the future. Development of residential and recreational properties that include homes, roads, and septic systems has occurred in recent decades, and would continue until available private lands reach capacity as determined by local zoning regulation. Increased development on private land would result in an increase in the amount of utility needs and road easements. This expected increase in roads for access to private land would further increase the road density in the Project Area.

CIVIL RIGHTS AND ENVIRONMENTAL JUSTICE

Existing Condition

Forest Service activities must be conducted in a discrimination-free atmosphere. Contract work that may be generated from this project would include specific clauses offering civil rights protection.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups should bear disproportionately high and adverse human health or environmental effects resulting from federal agency programs, policies, and activities. Environmental justice is also the identification of projects that are located near minority and low-income communities that have an adverse environmental impact. The purpose of the evaluation is to determine if a disproportional number of projects that have adverse environmental effects are located near minority and low-income communities.

According to the 2000 US census figures and the Forest Plan FEIS (HMNF 2006b);
10.3% of Manistee County's population is considered below poverty, 10.5% of the State of Michigan's population is below poverty, 6% of Manistee County's population is minority, and 20% of the State of Michigan's population is minority. The percent of low-income and minority populations for Manistee County is less than twice that of the State of Michigan (21 percent low-income and 40 percent minority). Further discussion and analysis of Social Economics is found in the Planning Record.

Effects Common to All Alternatives

No alternatives are expected to affect the civil rights of any landowners, or other individuals, near the Project Area. There would be no discrimination based on race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. The laws, rules, and regulations governing nondiscrimination conduct in government employment would be employed. None of the

alternatives are expected to disproportionately impact human populations. There are no human health or safety factors associated with the alternatives that would affect low-income or minority populations in or around the Project Area. The demographic information indicates none of the alternatives would affect environmental justice. Because civil rights, low income, and minority populations are not expected to be impacted by this project, there are also no expected cumulative effects.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Effects Common to All Alternatives

Irreversible commitments are decisions affecting non-renewable resources, such as heritage resource sites and soils. Such commitments are considered irreversible, because the commitment would deteriorate the resource to the point that renewal can occur only over a long period of time, at great expense, or if the resource has been destroyed or removed. Loss of soil due to erosion would be an irreversible commitment of resources. However, due to the incorporation of Best Management Practices, the mitigation measures and silvicultural prescriptions specified in this document (Appendix A), it is not anticipated that there would be any appreciable soil loss under any alternative from soil erosion. The loss of heritage resources sites resulting from accidental damage or vandalism would also be irreversible commitment of resources. Mitigation measures would provide reasonable assurances there would be no irreversible loss of heritage resources.

Irretrievable commitments are decisions affecting renewable natural resources, such as timber. Irretrievable commitments are commitments that result in the loss of productivity or use of resources due to management decisions made in the alternatives. These are opportunities foregone for the period of time that the resource is unavailable. Under Alternative 1, there would be no irretrievable commitment of resources. While Alternatives 2, 3, and 4 includes a short-term extraction of timber products from the forest, the forested stands proposed for treatment in this project would remain forested. Under all alternatives, the LSC for three stands would be changed to depict a more accurate and current characterization of the stands. The LSC in two stands would be changed from a forested to a non-forested condition. These stands were incorrectly classified as forested stands. The LSC for one stand would be changed from non-forested to forested because the opening has overgrown and becoming mostly forested through natural succession. All alternatives offer reasonable assurances of reforestation and provide for long-term sustained yield.